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TRS-80* COMPUTING EDITION

©1981 Percom Data Co., Inc.

The Percom Peripheral

35 cents

Percom's DOUBLER II tolerates wide variations in media, drives

GARLAND, TEXAS — May 22, 1981 — Harold Mauch, president of Percoin Data Company, announced here today that an improved version of the Company's innovative DOUBLER® adapter, a double-density plug-in module for TRS-80® Model I computers, is now available.

Reflecting design refinements based on both theoretical analyses and field testing, the DOUBLER IIT, so named, permits even greater tolerance in variations among media and drives than the previous design.

Like the original DOUBLER, the DOU-BLER II plugs into the drive controller IC socket of a TRS-80 Model I Expansion Interface and permits a user to run either single- or

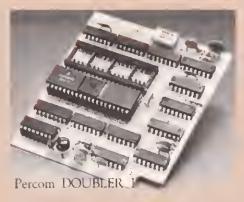
double-density diskettes on a Model I. With a DOUBLER II installed, over four times more formatted data — as much as 364 Kbytes - can be stored on one side of a fiveinch diskette than can be stored using a standard Tandy Model I drive system.

Moreover, a DOUBLER II equips a Model I with the hardware required to run Model III

(Ed. Note: See "OS-80": Bridging the TRS-80" software compatibility gap" elsewhere on this page.)

The critical clock-data separation circuitry of the DOUBLER II is a proprietary design called a ROM-programmed digital phase-lock loop data separator.

According to Mauch, this design is more tolerant of differences from diskette to diskette and drive to drive, and also provides immunity to performance degradation caused by circuit component aging.



Mauch said "A DOUBLER II will operate just as reliably two years after it is installed as it. will two days after installation.

The digital phase-lock loop also eliminates the need for trimmer adjustments typical of analog phase-lock loop circuits.

"You plug in a Percom DOUBLER II and then forget it," he said.

The DOUBLER II also features a retined Write Precompensation circuit that more effectively minimizes the phenomena of bit-and peak-shifting, a reliability-impairing characteristic of magnetic data recording.

The DOUBLER II, which is fully software. compatible with the previous DOUBLER, is supplied with DBLDOS*, a TRSDOS*-

compatible disk operating system.

The DOUBLER II sells for \$2 ing the DBLDOS diskette.

Owners of original DOUBLERs may purchase a DOUBLER II upgrade kit, without the disk controller IC, for \$30,00. Proof of purchase of an original DOUBLER is required. and each DOUBLER owner may purchase only one DOUBLER II at the \$30,00 price

The Percom DOUBLER II is available from authorized Percom rerailers, or may be ordered direct from the factory. The factory toll-free order number is 1-800-527-1592.

Ed. note: Opening the TRS-80 Expansion Interface may void the Tandy limited 90-day warranty. Orcle 258 on inquiry card.

All that glitters is not gold OS-80 Bridging the TRS-80* software compatibility gap

Compatibility between TRS-80° Model I diskettes and the new Model III is about as genuine as a gold-plated lead

True, Model I TRSDOS* diskettes can be read on a Model III. But first they must be converted and re-recorded for Model III operation.

And you cannot write to a Model 1 TRSDOS diskette. Not with a Model III. You cannot add a file. Delete a file. Or in any way modity a Model 1 TRSDOS diskette with a Model III computer.

Furthermore, your converted TRSDOS diskettes control be converted back for Model I operation.

TRSDOS is a one-way street. And there's no retreating. A point to consider before switching the company's payroll.

Real software compatibility should allow the direct, im-mediate interchangeability of Model I and Model III disket tes. No tead-only limitations, no conversion/re-tecording steps and no chance to be left high and dry with Model III diskertes that can't be rim on a Model I.

What's the answer! The answer is Percom's OS-80rd family of TRS-80 disk operating systems
OS-80 programs allow direct, inonediate interchangeability of Model I and Misdel III diskettes.
You can run Misdel I strigle-density diskettes on a Model III, install Percom's plugan POUBLER's adapter in your Model I, and you can run double-density Model III diskettes on a Model III.

There's no conversion, no re-recording.

Slip an OS-80 diskette out of your Model I and insert it directly in a Model III.

And vice-versa.

Just have the correct OS-80 disk operating system — OS-80, OS-80D or OS-80/III — in each computer.

Moreover, with OS-80 systems, you can add, delete, and update tiles. You can read and write diskertes regardless of the system of origin.

OS-80 is the original Percoin TRS-80 DOS for BASIC

programmers.

Even OS-80 utilities are written in BASIC.

OS-80 is the Percom system about which a user wrote, in Creative Computing magazine. "... the best \$30.00 tou will ever spend."

Requiring only seven Kbytes of menury, OS-80 disk operating systems reside completely in RAM. There's no need to dedicate a drive exclosively for a system diskette.

And, unlike TRSDOS, you can work at the track sector level, defining and controlling data formats—in BASIC.

to create simple or complex data structures that execute more quickly than TRSDOS bles.

The Percom OS-80 UOS supports single-density operation of the Model I computer — price is \$29.95; the OS-82D supports double-density operation of Model I computers equipped with a DOUBLER or DOUBLER II; and, OS-82III—for the Model III of course — supports both single- and double-density operation. OS-82D and OS-82III each sell for \$49.95.

Circuit misapplication causes diskette read, format problems. High resolution key to reliable data separation

GARLAND, TEXAS — The Percom SEPARATOR™ does very well for the Radio Shack TRS-80' Model I computer what the Tandy disk controller does poorly at best: reliably separates clock and data signals during disk-read operations.

Unreliable data-clock separation causes format verification failures, and repeated, read retries.

CRC ERROR-TRACK LOCKED OUT

The problem is most severe on high-number (high-density) inner file tracks.

As reported earlier, the clock-data separation problem was traced by Percom to misapplication of the internal separator of the 1771 drive controller IC used in the Model L

The Percom Separator substitutes a highresolution digital data separator circuit, one which operates at 16 megahertz, for the lowresolution one-megahert: circuit of the Tandy design.

Separator circuits that operate at lower trequencies — for example, two- or four-

megahertz — were found by Percom to provide only marginally improved performance over the original Tandy circuit.

The Percom solution is a simple adapter that plugs into the drive controller of the Expansion Interface (EI).

Not a kit - some vendors supply an untested separator kit of resistors. ICs and other paraphernalia that may be installed by moditying the computer - the Percom SEPARATOR is a fully assembled, fully tested plug-in module.

Installation involves merely plugging the SEPARATOR into the Model I El disk controller chip socket, and plugging the controller chip into a socker on the SEPARATOR.

The SEPARATOR, which sells for only \$29.95, may be purchased from authorized Percom retailers or ordered directly from the factory. The factory toll-free order number is 1-800-527-1592.

Ed. note: Opening the TRS-80 Expansion Interface may void the Tandy limited 90-day warranty. Circle 508 on inquiry card

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Artificial Intelligence-Technology and the Search 103 For Self

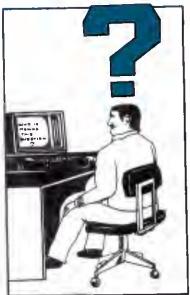
by Chris Brown

In the early 1950s, Lucy and Ethel found themselves working on a bon-bon production line and Alan Turing published "Computing Machinery and Intelligence." The world hasn't been the same since.

And Now Artificial Intelligence

by Harold Nalson

There has always been someone to put humanity in its proper place, scientists like Copernicus, Darwin and Freud. Now we have roast mules, Animal, and SHRDLU.



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by Nancy Robertson

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While the debate rages over whether or not machines can really think, a young computer scientist suggests man has jumped from the golden bough to be left swinging from a golden braid.

Mastermind—An Intelligent Program

by Duane R. Hope

When this author got bored with solo play of this popular game, he decided to create a worthy opponent inside his computer.

Simple Syllogisms

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If you've ever fantasized about having an intelligent computer, here's a way to add some smarts to your little black box.

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"Before...computer artificial intelligence ...we have to come to terms with what we mean by 'intelligence.'

Artificial Intelligence, Eh?

hat gets the same sort of snickering laugh from methat I provide the robotoriented folk. You know how to make a robot, don't you? Well, you start with a British midget...

Before we can tackle computer artificial intelligence we have to come to some terms with what we mean by "intelligence." Frankly, even with our largest computers we are still far away from anything remotely describable as intelligence. As measured by psychologists, intelligence has to do with the ability to cope with a new situation: This is the opposite of the normal computer approach. A computer can only cope with those things for which it has been designed to cope.

In addition to our brains being several orders of magnitude more complex than even our best computers, there may be other more serious obstacles in the way of creative problem solving by computers. Take the simple matter of memory—have you any idea how your brain stores information? I hope you said no, because no one yet has even a hint as to how, or where, we store all the data we pick up.

If you add up the amount of input to the brain—from the zillions of rods and cones in the eye, at so many frames per second; from the ears, nose, touch all over the body; temperature; kinesthesia; pressure; and so on—the amount of material put into storage is incredible. We seem to forget most of this input, but under hypnosis we are able to regress and get back full perception from any time. The information is recorded; it is only our ability to contact the recordings which is a problem.

I remember when a chap first came out with the announcement that It was possible to go back in memory to the prenatel period. Boy, did he get the hee-haw. Today it is commonly accepted, complete with the ability of anyone not only to recall events but to recall voices and things that were said near one during that period of life. I've personally regressed many people to the prenatal period and had them play back their recorded memories. Qften these memories have a surprising impact on present day life.

Prenatal memories are unlike later ones, in that they are mere recordings of perceptions and can only be recalled under hypnosis, bypassing the conscious mind entirely. The prenatal conciousness didn't know what the sounds meant, so they were not interpreted and filed under as complex a cross index system as are later memories.

Getting back to memory, it appears we are able to store considerably more data than the brain can possibly hold. When we touch some parts of the brain certain memories are stimulated, but this may be because we have hit a switching circuit rather than a memory storage area. Removing large hunks of the brain does not always remove memory.

It may be that we are able to use a holographic type of storage system, somehow storing large numbers of memories or a few molecules. But I'm skeptical about that; in view of our ability to recall things throughout our lifetime with amazing clarity, in spite of our cells being constantly replaced, I wonder if we aren't using some outside storage medium.

If you've read much about dying and death, you are aware that we have an incredible body of evidence that there is part of our being called the spiritual which seems to continue after death. This part of us seems to retain all those memories which were supposedly buried with the body. So, there might be some sort of limitiess, timeless storage system we use. Physical problems with the brain-or programming problems-can interfere with our memory access. Hypnosis and other sneaky techniques known to psychologists make it relatively simple to access even the most hidden (by programming) memories.

If I'm right about this, our electronic computers are going to have a heck of a job matching us in memory capacity, even with laser disks. And then comes the complex system of indexing we use. Perhaps you heve to have done psychological work to appreciate how perfect an instrument the brain is and how invariably it will respond to a request on the unconscious level. If I get you to relax and ask you to return to a time when you were eating a ham sandwich, your mind will—infalli-

bly—do just that. If I ask you to return to an earlier ham sandwich, it will. And I can take you back to the first ham sandwich you ever ate. It's all there, when you know how to access It. All cross-indexed beyond the wildest hopes of any computer imagined today.

That brings us back to the concept of intelligence—the ability to cope with a new situation on the basis of past information. The built-in indexing system we have can break down a new situation into extremely small parts, all on an unconscious level, and develop a scheme for meeting a completely new event. The better able the brain is to do this integration, the higher the intelligence. People with a high IQ have a better working computer system.

As one of the founders of Mensa, the high IQ society, I've met and talked with hundreds upon hundreds of people with high IQs. Yes, they have good computers, but that doesn't mean they appear very smart. Let's draw a parallel with one of our microcomputers. If we give our computer a very limited amount of data with which to work, and then we make sure that part of that data is not true, and then, just to really screw things up, we program the system with a crummy program, we can see that the computer itself is of less significance than we thought.

People are programmed, beginning with that prenatal time. If they are taught values which are not true, given data which is not factual, it really doesn't make any difference how fantastic their computer is, they will still do dumb things and be failures. I hope I will not make any additional enemies, but the truth is that the Mensa people are no more successful than anyone else. I have found no correlation between intelligence and success.

The Mensa people do seem to have a better computing system, but then, no one ever claimed that everyone was equal in any way. Some make a big deal out of being intelligent. But then, some people use their height in similar ways—or anything else they inherited which is deemed superior in our society.

I suppose that if we could build a computer system big enough to store as much as we can with our minds which had the ability to cross-index as well as we do, we

80 REMARKS

might then start talking in terms of artificial intelligence. Until then, please don't bug me.

If you want to take Issue over the concepts of a spirit body, please do me the kindness to read the literature before discussing it. The same goes for reincarnation, communications with the dead, and all that occult stuff. And don't forget to come to grips with parapsychology, mental communications, ghosts and other psychic phenomena.

Regaining Our Technology

It should be no secret that Japan has passed us by in much of our electronic technology. I've written a good deal about that in the last few months, and the reason I think it became possible. Part has to do with the support the Japanese government gives their electronic industries, the tax benefits, the low cost loans, and the skilled training for their workers. But part of the problem, I'm convinced, lies in a little-known event that occurred almost twenty years ago.

In 1963 proposals were made to change the ham rules. With about 85 percent of the hams believing they would have to take the difficult FCC exams over to get back their frequencies, spirits dropped and amateur radio growth stopped dead for over ten years!

If ham growth had continued as it had from the end of WWII, we would today have over two million hams and over half of these would be engineers and technicians, working in our electronics and communications firms. Well, we lost out on about one million engineers and technicians and there is no way that the loss of that many technical people—particularly hams, who are the most rabid of the lot—hasn't hurt our technology.

At the same time we stopped our ham growth, the Japanese set up a no Morse Code license and their ham population has far surpassed ours, even though they have only half our population. When I visit the computer labs in Japan I am greeted as W2NSD and known through 73 Magazine. I see hams all through their labs.

Remember, if you will, that virtually every major communications break-through has been discovered and ploneered by hams. FM was ploneered by hams, NBFM was too, as was sideband, RTTY, and so on.

The new generation of computer hackers may, to some degree, help us through this technician famine, but we need to do something on a national level to get interest in electronics, computers and so on into our high schools and infect our 14 and 15 year olds with the ham and computer virus. We are way behind now, so it

Is going to take a lot of work to catch up. I spoke recently to the chairmen of the FCC about this and there is a good possibility we may be able to get this to the White House for consideration.

One coffege can't turn out a million technicians, but if we can get amateur radio going again—perhaps with a version of a no-code license—and we can get schools to push computers, we could catch up to the Japanese by 1990. We're not going to do it by accident, that's for sure.

Micro Mountain

bout a year ago I got to talking with the presidents of two local colleges about my plans for introducing microcomputer courses into their educational curriculum. Both liked the idea and we started to lay the groundwork.

Then I got a call from one of them saying he wanted to get out of the college business and wondered if Wayne Green Inc. was in any position to take on a college. We weren't at that time, but I started thinking seriously about it and looking for someone with the background to tackle the job. You don't find someone with the ability to run a college quickly, so the college was eventually sold to a Florida school.

The college was a nice one, with 800 acres and 15 major buildings, but it had drawbacks, too. It had been built in the days of cheap energy and was a bear to keep heated in the winter. The spread-out buildings meant extensive plowing after every snow storm—and so on.

Just recently we lucked into a chap with the right background to get our school started. Since then I've been giving a lot of thought to the plans and they have been growing almost daily. A recent NBC White Paper on training workers fueled the fires of imagination.

Since 80 percent of all new jobs come from small firms—particularly new firms—why not think in terms of an industrial area centered around the school? This would allow entrepreneurs to open small firms and make use of students as part of the teaching process, providing workers of outstanding intelligence and skills at a low cost.

i had been thinking in terms of a school which would have an 18-24 month course, resulting in an Associate's Degree. Part of that time would be spent learning theory and the other part doing practical professional work, either with instant Software or with one of the other nearby commarcial firms. Thus, each student would get the benefit of practical on-the-job training as well as theory and associated business courses.

Could we build an eastern counterpart to Silicon Valley, calling it Micro Mountain? After talking with the people at Atari and Apple and smaller firms in the micro-computer business, there is no question in my mind about the need for skilled people: The industry needs them badly. Indeed, the lack of skilled workers has been seriously holding back growth of the field and the situation is only going to get worse.

The courses I had in mind for the school would start with an understanding of microcomputers; how they work; how to fix them; how to interconnect accessories and get them to work. We'd explain the architecture of the popular chips and the reasons for support chips. I'll bet we could get some help with these courses from chip manufacturers—they need skilled people too.

Then we would go on to printers, disk drives, and other accessories: how they work, how to fix them, and why they have been designed the way they were.

Software would come next, with introductions to all common languages and heavy emphasis on Basic and perhaps Pascal. We'd go into operating systems, machine and Assembly programming, utilities and how they simplify programming and service of systems. Then we would get into teaching about the many applications programs—how they work, what to look for, how to fix them. We'd work with as many different word processors as possible, accounting packages, and industry-specific packages.

Man does not live by computers alone, so we would also teach a variety of business programs such as business law, how to buy or rent buildings, personnel management, how to apply for and get a job, finance, accounting and bookkeeping, advertising, promotion, writing, editing, printing, marketing, packaging, Z-theory, photography, and so on. We want students to be able to go to work for a firm and be qualified to proceed to upper management.

The idea seems like one whose time has come, so we'll be developing it and looking for support from the industry.

Computers and Hamming

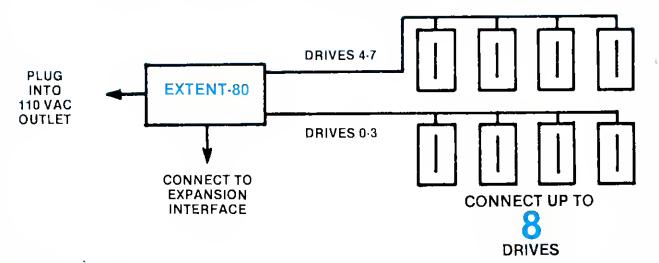
hams already into computers it is a wonder so little has been done to marry the two interests. One of my other publications, 73 Magazine (for radio amateurs), is going to take the big step and put the two together with an on-the-air ham bulletin board system.

The idea is to have one channel where

Continues on page 67

Expand your TRS-80® MODEL I with

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"Those of us who have been using Model IIIs...know what frustration is all about."

READY or Not. . .

I am writing in response to Ron Balewski's article "Never Ready" (July 1981). He stated in the article that the message string that was to be displayed instead of READY would not appear after CLOAD because it uses a different address for reentry to Basic.

But, it is possible to make this patch into the RAM location that is called upon reentry to Basic. So, I have written a very short routine to handle the flaw in the program. It only uses 5 bytes, thanks to a little ASCII character called the upward lineteed (27 decimal or 1B hex). I have never seen this character used in a program before although it seems to be a very handy character to use. This is the routine:

LD A,fBH ;Up-ward Line-feed CALL 33H ; (Dispfay at cursor

This requires the following changes in the Basic program:

30 FOR K = 32683 TO 32703:READ D,POKE K,D:NEXT K

And add the following lines:

35 DATA 62,27,205,51,0

125 K \pm 16821; POKE K, 195: POKE K + 1,171: POKE K + ,127

Be sure to set the memory size to 32683 instead of 32688 before running the program.

Craig Riecke Lincoln, NE

What About Level I

I have just read the June 1981 issue of 80 Microcomputing, the first subscription copy that I have received (the transation-tic postal service is not as efficient as it could be), and I must say that I was very impressed. It is fair to say that a single issue contains more information on the TRS-80 than the three leading UK microcomputer publications combined in an entire year.

But... there wasn't a single item on or program in Level I Basic. Surely some of your readers have TRS-80s equipped with Level I? I know the general idea is that Level I is OK for starting with and Level II or Model III Basic is required for serious use, but it depends on what you mean by

serious. My Level 1 system plays Chess, Star Trek, Adventure, runs the Editor/Assembler and will shortly be doing some simple word processing, thanks to the Electric Pencil. In fact, it does everything I want a personal computer to do, so why bother upgrading to Level II? (I should add that I am fully familiar with the facilities of Level II and Disk Basic).

About a year ago I helped form the UK Level I User Group, which is dedicated to TRS-80s equipped with Level I Basic, and to making them do more than people think they are capable of. The group's main activity is the production of a bi-monthly newsletter/magazine, and tellow 80 Microcomputing readers are invited to write to me for a sample copy (free, but please enclose \$1 for postage).

Nick Rushton 123 Roughwood Drive Northwood, Kirkby Merseyside L33 9UG United Kingdom

Pilot Praise

The following is an open letter to Randy Hawkins, author of "Pilot—The Language of Computer Aided Instruction" (July 1981).

I've deait with all kinds of people over the years, but never anyone who was as prompt and courteous as you. When you told me last Saturday you'd mail a fix for your Pilot program on Monday, I expected that would be the lest I'd heer from you... at best it would be weeks. But this afternoon's mail brought your four-page Model III changes.

Next, don't apologize for Inconveniences. Those of us who have been using Model Ills for some time know what frustration is all about.

Now, for some items on how it's working for me. After debugging it, I found the system tape wouldn't load. I sat here staring at the ** on the screen and watching it switch to D* at the very end of the program. I made extra copies. Normally, the D* message tells me I've got a problem with volume settings, aithough it's mighty rare on the Model III. If it persists, I clean

the heads, then normally it boots up without any trouble.

But your Pilot 80 sat there sticking its D* tongue out at me every time, no matter how I adjusted the volume. Finally, a little bell went "tinkle-tinkle" in my head. This month's *Microcomputer News* (from Tandy), mentioned that Haunted House will load in the Model III if you simply load it over itself on a checksum error. Next time around, I watched the ** change to D*, then a pause while it passed the blank portion between saves, then another series of blinking D*s, and danged if it didn't perform like a charmer!

I found when putting in the tutorial program that your suggestion to use "a" instead of "@" or the shifted "@" was of little help. It worked fine everywhere except in line 325. I went over that damned line at least 20 times; I edited it, rewrote it, deleted it and rewrote it, and no matter how hard I tried, I couldn't get that "a" to appear on the screen. It came out "A" every time. Well, you warned us that using two quotations in a line could lead to unpredictable results. Have you ever edited a line, hit L several times and saw it was letter perfect, then entered and listed it? Comes up "A".

My final attempt was to delete lines 305 to 330, name the program to the end, and then redo the missing lines, this time combining lines 320 and 325. Now I had three quotes in one line. But it worked perfectly.

I can assure you Pilot will make some of my self-imposed tasks easier, and produce neeter programs when I want to create a tutorial. Even though my system is 48K and I can't make use of 16K of my RAM, I take my hat off to you for an excellent program. I have also stuck your name in the master tape where it belongs to identify your work.

Karl H. Meyer Corpus Christi, TX

Bungled Broker

Your article "The Software Broker" (June 1981) contained many serious mistakes. The following are some that I have found. There may be more.

Continued on page 14



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in a couple of months MTC will introduce the in a couple of months MTC will introduce the successor to AIOS-III/CALCS. It is celled AIOS/P¹⁰ and is besed on MTC's PRIMAL²⁰ (Practical Relational Intermetion Management Applications Library), a powerful system for PRIME minicomputers. AIDS/P features the best of the criticelly acclaimed AIDS-III/CALCS but is probably an order of magnitude beyond it in power. It will be first made available to AIOS-III/CALCS owners (for an upgrade charge), then to the general an upgrade charge), then to the general public. Price will be in the \$200-\$300 range.

Effective September 1, 1981, Metatronics Corporation became a subsidiary of MTC. Metatronics will carry the complete MTC product line in addition to its own. Order processing and futifiliment departments have been combined to improve service response ievels. MTC's superior softwere and supplies merketing, and Metatronics excaptional peripheral offerings should prove to be a foundable combination. (Sorry guys, if you can't be cen't beet us, join us . . .)

MTC now offers a more complete selection of diskelle products (ad deadlines prevented in-clusion in anything but this column). New menufecturers ere MAXELL and 3M. Definitely call for specific information. For exemple, MAXELL Brand S¼ " diskettes in a PLASTIC LIBRARY CASE are only \$34.95 for a box of 10! SCOTCH Brand diskettes are comparably velue-priced. MTC is also introducing its own PARAGON™ Brand medie products. The in-PARAGON™ Brand medie products. The intent is to offer a super-high quality product at a very competitive price. For example, a box of 10 single-sided, soft-sectored, double-density, 100% certified diskettes with HUB RINGS is only \$24.85! A full time of products (including HEAD CLEANINO KITS, etc.) will be offered. The PLAIN JANE™ (almost 200,000 units sold) diskette line will become pert of the PARAGON™ MAGNETICS operation (but don't quote its vertiation). don't quote us verbatim).

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Break Solution

In reference to TRSDOS POKE (June 1981), defeat the Break key under TRSDOS 2.1/2.2/2.3, NEWDOS 21 or ULTRADOS, I use the following line: POKE PEEK (17171) + PEEK (17172) *256 + 1, 0. To turn on: POKE PEEK (17171) + PEEK (17172) *256 + 1, 1

Please note this does not work with NEWDOS 80, DOSPLUS nor ULTRA-II. These new systems have the ability to defeat the Break key via a system or library command.

> Vernon B. Hester 42403 Old Bridge Road Canton, MI 48188

Data Inputs Wanted

Would it be possible to complement a wonderful program ("The Software Broker," June 1981, p. 268) with a short explanation of how to prepare the data disks (mainly the stock price data and the index values)?

I don't understand how you can do it from lines 300-380 on Program Listing 1. The variable D9A will accept only numerical data—what happens to the name of the stock, for example.

In spite of the tremendous amount of space that you dedicated to this program I think it would have been very nice to have a sample of data inputs at the end of the program.

Harold E. Lange P. O. Box 450182 Miami, FL 33145

Disappearing Act?

About a year ago I purchased a machine language program on cassette for my TRS-80, which was similar to the arcade or "Space War" game for Apple. Since that time I have searched for another copy as the tape worked twice, then would not load. In trying to track down the original supplier (I think the name was "creative software" or

"creative games" or something similar) there was no phone number and returning the tape for replacement only resulted in a reply of "addressee unknown." I therefore assumed the company had gone out of business.

If anyone can supply information concerning the demise of this company, or of a new supplier, it would be greatly appreciated.

> Douglas C. McMillan 105 Burlington Beach Valparaiso, IN 46383

OM Error Fix

I'm writing in regard to my letter published in July 1981 concerning the OM error I received on loading KBEEP-FIX. The response was outstanding; I would like to thank all those who wrote to me. It appears the answer Is to JP to O6CCH, rather than to 1A19. At least this gets rid of the dreaded OM error.

Now I have a new question. Is there anyone who knows of an add-on disk controller unit other than the expansion interface. (I am mainly interested in an already assembled, ready to plug in unit—not one that has to be assembled or searching for parts as in the LNW board). I would like to hear from any one who knows of a unit.

Bernard F. Gaffney Jr. 524 Riley St. Lansing, MI 48910

POKEing Along

In reference to your column, 80 Aid, (June 1981), about the various POKEs required to disable the Break key, I have done a bit (pardon the pun) of research and created a list of POKEs for Level II and various DOSers, including TRSDOS versions 2.1 through 2.3, Apparat's NEWDOS PLUS, and Apparat's NEWDOS 80.

Robert Churchill 2390 California St. Saginaw, MI 48601

IRV Solution

This is in response to the letter of Rev. Richard W. Beebe (March 1981) regarding problems getting IRV to work with TRSDOS 2.3. I had similar problems with NEWDOS but found a way out. I tried this solution with TRSDOS 2.1 and it works. (Sorry, but with all the well-known problems of 2.1, I never bothered to upgrade to 2.3, settling instead for NEWDOS.) I figure if anything, it will work with his TRSDOS 2.3.

His best bet is to get IRV into RAM using TRSDOS command Load IRV, then invoking Debug and pressing the Break key to activate Debug; then get into IRV by entering the Debug command GAAAA. AAAA equals the execute process on page 5 of the IRV brochure (e.g., for his 48K system it would be GFD36).

Incidently, when IRV is operational it does not work with Electric Pencil and will reboot the system when returning to DOS. It also disables the chain command of NEWDOS 80. If anybody has figured patches for these problems I would welcome them very much. IRV is a very powerful utility and I bet it has still many undiscovered uses.

And speaking of Electric Pencil and the NEWDOS-80 chain command, a DOS command file can be made by Pencil, saved on disk as filename/PCL then activated by chain filename/PCL.

Alan H. Hyde Jaimovich, MD 440 West Foothill Blvd. Glendora, CA 91740

Printing a Disk Directory

I am looking for information on how to get a disk directory printed on a printer. I have a TRS-80 Model I, and I am using TRSDOS 2.3. It would be very helpful in organizing my disks. I would appreciate any information.

> Michiel van de Panne Box 13, Site 16, SS1 Calgary, Alberta T2M 4N3 Canade



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One glaring incidence is in "UPDATE/DTA", line 1420 which reads: For P39 \simeq 1 TO 80.

This error occurs several times. I am sure that something else was meant, but what?

Another is in "STOCK/ANA," lines 170 to 180: 170 SP = $\{(P(A) - PZ)[2 + SP]$. It should probably be: SP = $\{(P(A) - PZ)[2 + SP]$. Ditto for line 190.

In the program named "BREADTH/MKT" there is a mistake in the establishment of the value of L. I think that the problem is in lines 360–380, but not knowing what the author meant I'm not sure.

Also trading volume as written produces nothing but a series of #'s and + 's on the printer.

I am sure that there are other mistakes, but I have to get past these first. I sure do wish that these programs were tested before being published. It sure would save a lot of aggravation.

Also in the program "Real Rule of 78s" the Stop statement should not be in the program if it is to continue.

Richard Eidmann Philadelphia, PA

Bad Listings

With the renumbering utilities around, why can't you clean up the listings you publish? S. Hunter's "Sans Disks" (April 1981, p. 186) is a case in point.

Robert McDaniel Clifton, NJ

Your point is well taken. However, renumbering programs may involve re-writing a whole manuscript so that references to the program still make sense. It's really up to program authors to submit their programs to the magazine in as tidy a form as possible.—the Editors.

Computers for the Needy

Santuary, Inc. is a non-profit, non-sectarian organization which aids young-sters who have special problems. They are placed in the home for guidance and counseling. The home is staffed by professionals dedicated to assisting young adults. The school is a public institution which is operated on what little federal funds are available and on private donations. Needless to say, the funds are not sufficient to sustain the children's needs.

I am not affiliated with the school; however, I know its director, Sister Albina Guiilory, M.S.C. She has told me of their lack of educations equipment, personnel and operating funds. She has worked actively just to keep the home open. Its over-extended facilities are in need of annexation. She says that the demands on the school far exceed its capabilities.

I suggested to her that I would write a number of microcomputing magazines for assistance from its readers. You already know the capabilities of computers in education. I know that you can see the added advantages of CAI to special students who need that added patience and encouragement that few teachers are able to devote to their students on an individual basis.

If your readers would be able to help these youngsters in any way, I know that Sister Albina would be more than grateful to them. Please remind the readers that their donations ere tax deductible and that the rewards of satisfaction from assisting these kids are well worth their efforts.

For those of you who would wish to send contributions of herdware, software, firmware or other assistance, please mail it to:

Santuary, Inc 1120 Fair St. Eunice, LA 70535 1-318-546-0551

Thank you for your consideration in this matter.

Roger C. Bull Gretna, LA

Say What?

I have a few comments on "Regression and Correlation" by C. Brian Honess (July 1981).

When you fit a set of points (X,Y) to a polynomial model (i.e. $Y^1 = Eb_1 - x_1 + a$), it is normally called "polynomial regression" and is distinct from nonlinear regression. In the fatter, the nonlinearity refers to the relationships among the fitting parameters, not the linearity of the model itself. Thus, any function of the form $Y^s = E_{ij}(X)b_i$ + a is linear in the fitting parameters (a and bi). A nonlinear model that is nonlinear in the parameters is any function that cannot be formulated in this manner. For example, $Y = b_1 e^{-xb^2}$ is nonlinear in the parameters. Note, however, that this particular function can be made linear through the use of a logerithmic transformation, e.g.: log $Y = log(b_1e - xb2) =$ $log(b_1) \rightarrow b_1 log(x)$.

Also, the method used to extract determinates is archaic. A much better method is to use Gauss-Jordan elimination to implement an upper triangular matrix trans-

formation. This method is simpler, tester and easy to program. It also allows expansion to any size square matrix without rewriting the program, whereas the algorithm presented here is size dependent.

I am glad to see that your fine publication includes an occasional article that deals with mathematics. I hope this trend continues.

> Bruce Douglass Dept. of Physiology University of South Dakota Vermillion, SD

Subscript Reconsidered

Thank you very much for reviewing our Subedit/Subscript Word Processing software in the June issue. We appreciate the coverage and the encouragement you've given us, but regret that some of the inaccuracies and omissions in the article misled many of your readers and cost us a number of sales. We know this was inadvertant, and to mend some of the damage, we would like an opportunity to offer some clarification and updated information.

You indicated that Subedit/Subscript is written in Basic. However, Basic comprises less than 50 percent of that package (and only about a third of its successor, Newscript). The text formatting routines and the keyboard interface (Mininit) are in machine language. As a result, the system can keep up with any typist (2500) wpm, which is faster than the TRS-80 normally runs), and drive a 100 CPS printer at full speed most of the time. We used Basic for file I/O, storage management and printer tailoring; and machine language for speed. The combination is ideal: it makes it easy for us to distribute corrections, and easy for our customers to tailor Subscript to unusual needs, Given these speeds, there is little reason to convert the rest of the package to machine language. Since we encourage our customers to make backups, we saw no need to use machine language just to protect the code.

Of course, the original claim to fame of Subscript is its support for the Line Printer IV (Centronics 737): Subscript automatically performs right-justification of proportional font, allows inter-mixing of double- and single-width characters, performs underlining and does sub-scripts and super-scripts. It was the first TRS-80 Word Processor to offer these features, but the review article unfortunately didn't mention any of this support. We do thank you for describing how thoroughly we support

Continued on page 16



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the MX-80, and wish to mention we also support the Diablo 1620, Selectric and other similar printers. We also were the first company to offer and deliver disk-based word processing for the TRS-80 Model III.

The review did identify a characteristic of Subedit that some people found annoying: the need to hit Enter after every 255 characters. I'm one of those people, and as the author, was in a position to do something about it! The result was Newscript, with a full-screen editor modelled atter IBM'S Edgar and SPF, and which takes advantage of the unique abilities of the TRS-80. By coincidence, our first ad for Newscript was run in the same issue as your review article. I'm not sure if the ad overcame the effects of the article or was discredited by it...! only wish you had looked at your own advertising before running the article, or called us to verify its accuracy.

Newscript has all 50 of the formatting features of Subscript, plus some new ones. However, most of its enhancements are in the text entry and revision areas (Editing). The Mininit keyboard interface is built-in. The Full-Screen editor (written in machine language) scrolls, has a Whoops command, opens windows, moves words to the next line of the screen, allows the cursor to be placed anyplace on the screen, and permits insertion, deletion and overlaying of data directly at the cursor position. With its standard typeahead feature, Newscript can accept over 750 keystrokes per second (that's 7500 words per minute, which is probably fast enough for most of us) without ever losing a keystroke even at the end of a line. I mention all this mostly to lay to rest any notions some people may have about the slowness of Basic or the TRS-80; properly programmed, (as we have done), it's as fast as a small mainframe computer!

> Chuck Tesler Prosoft North Hollywood, CA

Shell Sort Looped

It is said that each type of sort has its advantages and disadvantages. The Bubble sort is the slowest, however it takes the least amount of programming effort and space. The Shell-Metzner sort is one of the fastest and most practical sorts to use, but it takes a lot of program space.

I personally have found the Shell sort to be the best. I see no reason why if must take up so much space. In every book or magazine where I have seen a Shell sort listed, it is always in a longhand program style. I don't understand why no one has

been creative enough to put the Shell-Metzner sort in For... Next loop form, but this routine took me a few short minutes to put together from the standard Shell sort flow chart.

Steven Graham Forest Hills, NY

Memory Lapse

I have reached the point of pure sickness at Radio Shack. They try to get you to buy their software and hardware, but when you upgrade to disk and go to transfer the programs you have such as Pyramid, Invasion Force, and Eliza to disk they tell you you need the memory addresses, and even when you need to relocate them Radio Shack doesn't lift a finger to help you.

We trusted Radio Shack with our hardearned money for their computer, and they stapped us in the face with the used car salesman "Trust me" routine. It's time to remind Radio Shack that we are paying for their goods, and without us they'd crumble.

> Robert Rose Oakland Park, FL

Just What He Needed

Mr. Rose's complaint is a valid one; I'm sorry we haven't taken care of this one sooner.

Here's a list of the necessary addresses:

	Start	End	Entry
Micromovie—(MOVIE)	4300	4CFF	4300
Eliza—(ELIZA)	5000	7800	5000
Talking Eliza(ELIZA)	4600	7C00	4600
Microchess—(CHESS)	canno	1 load t	n
	disk, s	pecial	load-
	ing for	mai.	
Micromerquee-(MARQ)	4A00	4FFF	4B00
Invasion Force—(INVADE)	5000	7100	5000
Flying Saucer—(SAUCER)	42EA	4FFA	42EA
Editor Assembler—(EDTASM)	4300	5D40	468A
TBUG L = III(TBUG)	4380	4824	43A0
In-Memory			
Initialization			
L·II—(INITLZ)	4380	478C	4380

Retrieval				
L-II(RÉTRÉV)	4380	488C	4380	
Sort L-II-(SORT)	4390	46DE	4380	
Checkers 80-(CKRS80)	5000	7700	5000	
Program Conversion—(CONV)	4AF6	4F07	4AF6	
Data Conversion—(DCONV)	4300	4525	4300	
Micromusic—(MUSIC)	4300	4970	4300	
Renumbering Program—(RENUM)	7C4C	7FC6	7C4C	
Term—(TERM)	5000	508F	5000	
Pyramid—(PYRMD)	4300	7FFE	4300	
Haunted House—(HAUNT)	42E9	4FFF	42E9	
Scripsit Cassette-(SCRIPS)	4300	69C5	4300	
Upper & Lower Case Driver				
Basic-(ULCBAS)	6C00	7015	6C00	
Disk(ULCOVR)	7000	73FF	7000	
	F	111 W	alters	

Consumer Information Manager Tendy/Radio Shack Fort Worth, TX

OP Code Change

After reading Brian Cameron's article "Undocumented Instructions" (July 1981), I began looking through op code tables out of curiosity to verify some of the codes. They are indeed undocumented. After further researching, I found that Mr. Cameron's title of 'DUPINC' for the instruction to multiply by two and increment is actually 'SLL' (Shift Left, Logical). The other op codes he names appear correct.

Just for the record, I'm 16 years old.

P. Griffith Tampa, FL

Reversing Graphics

Regarding your article on graphics codes ("Unlocking the Graphics Code," June 1981), there is third application. Through a little meth, a graphics pattern can be reversed—exchange black for white and vice versa. To see how this works (Model I and Model III), type in the following:

10 CLS: for X = 128 to 191: PRINT @ 0.X.: POKE 15365, x 20 POKE 15370, 191 – (PEEK(15365) – 128): FORY = 1 to 300: NEXTY.X.

The contents of 15365 are reversed and POKEd to 15370. To reverse all graphics on the screen, use the subroutine: 10000

Continued on page 20

1000 ****** SHELL-METZNER SORT SUBROUTINE *****

A\$()---THE LIST TO BE SORTEO

NE-----THE NUMBER OF ELEMENTS IN THE LIST

1010 M = NE

1020 M = INT(M/2):IF M = 0 THEN RETURN

1030 FOR I = 1 TO M : FOR J = 1 TO NE - M;1 - M STEP M : FOR K = J + M TO NE - M + 1 STEP M

1040 IF A\$(J)>A\$(K) THEN T\$ = A\$(J):A\$(J) = A\$(K):A\$(K) = T\$

1050 NEXT K,J,I:GOTO 1020

Program Listing



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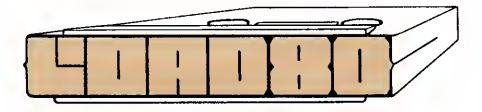
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80 Microcomputing Pine Street Peterborough NH 03458 Afth: Debra L Boudrieau

80 DEBUg

Broker Botches

I have found an error in one of the listings contained in my article "The Software Broker" which appeared in the June 1981 issue of 80 Microcomputing. In the 'MOVING/AVE' program (Listing 4), line 200 now reads: 200 A = Q + 1. This should be changed to: 200 Q = Q + 1: AV = 0.

I am sorry if this has created a problem for any of your readers.

> John Harper Rte. #1 Box 252 Lawrenceburg, IN 47025

Hi- Res Help

The April 1981 issue of 80 Microcomputing had one error in the "High Resolution Video Interface" article. The headlines should have read 192 by 96, not 192 by 26. Also, the schematic shows a 5257 or 4041 as the memory chips. The 4041 is getting difficult to find so use the TMS-4044, MM-5257 or INTEL 2147.

Several recurrent questions have come up that I would like to take the opportunity to answer. The size of the HR-1 board is 3 by 7 and 7/8 inches. Second, the size of the smallest dot is equivalent to the size of the period on the TRS-80 CRT and 18,432 of them can be defined anywhere on the screen. The normal TRS-80 graphics can define only 6144 individual dots.

Third, is the complete (assembled) unit available? At this time, only the circuit board is available. However, there is a company in Augusta, GA, Cardin and Associates, that is considering supplying kits and fully assembled boards. Judiclous buying should allow you to gather all the parts (including circuit board) for \$75 to \$80. The six memory chips are the most expensive items. Some distributors want up to \$16 each for these ICs, but they are evailable for less than \$5 each from Continued on page 22

Dirprog Update

In the August 1981 issue of 80 Microcomputing, we published an article called Dirprog by Jack Egbert. Unfortunately, we ran an older version of the program. The program listing here is the updated (better) version of Dirprog. We hope this eliminates any confusion publishing the older version may have caused:

```
*** DIRPROG
   28 * A PROGRAM TO MAINTAIN A DISK DIRECTORY INDEX FILE
 20 * A PRUGRAP 10 M.
30 :
48 * VERIFY GSF48/OBJ IS IN MEMORY, INITIALIZE IT
50 IF PERK(88FRE0) <>205 OR PERK(68FFRE) <>26 CLS:PRINT@192,
" ** GSF48/OBJ NOT LOADED **
LOAD GSF48/OBJ -- AND THEN DIRPROG":PRINT8983;:END

60 DEFUSR-&HFER8:CLEAR:PORE -1,0

70 AS=""IDNS=":ES="":SWS=":ITS="":TPS="":WF=0 ' WRITE FLAG=WF

80 CLEAR 16080:INF PNS(952), UNS(952)

90 DEFINT J,X :XX=0

100 CLS:PRINT8156," MENU":PRINT

110 PRINT, '< R > -- READ FILE FROM DISK"

120 PRINT, '< R > -- READ FILE FROM DISK"

120 PRINT, '< R > -- ADD TO FILE"

140 PRINT, '< A > -- ADD TO FILE"

140 PRINT, '< B > -- EDEETE"

140 PRINT, '< C > -- EDEETE"

150 PRINT, '< C > -- FIND A PROGRAM'

170 PRINT, '< C > -- ENIT THE PROGRAM'

180 PRINT, '< C > -- ENIT THE PROGRAM SAVING INDEX"

180 PRINT, '< C > -- ENIT THE PROGRAM SAVING INDEX"

280 PRINT; PRINT'INPUT YOUR SELECTION . . . ":COSUB 1608

210 IF AS="R" GOSUB 938:GOTO 100

230 IF AS="W" GOSUB 358:GOTO 100

230 IF AS="S" GOSUB 1650:GOTO 100

250 IF AS="S" GOSUB 1650:GOTO 100

250 IF AS="S" GOSUB 1650:GOTO 100

270 IF AS="S" GOSUB 1400:GOTO 100

280 IF AS="C" GOSUB 1328:GOTO 100

290 IF AS="C" GOSUB 1328:GOTO 100

290 IF AS="C" GOSUB 1328:GOTO 100

290 IF AS="C" GOSUB 1328:GOTO 100

291 IF AS="C" GOSUB 1400:GOTO 100

291 IF AS="C" GOSUB 1328:GOTO 100

292 IF AS="C" GOSUB 1650:COTO 100

293 IF AS="C" GOSUB 1650:COTO 100

294 IF AS="C" GOSUB 1650:COTO 100

295 IF AS="C" GOSUB 1650:COTO 100

296 IF AS="C" GOSUB 1650:COTO 100

297 IF AS="C" GOSUB 1650:COTO 100

298 IF AS="C" GOSUB 1650:COTO 100

299 IF AS="C" GOSUB 1650:COTO 100

290 IF AS="C" GOSU
                                   LOAD GSF48/OBJ --- AND THEN DIRPROG": PRINT@900.: END
   330 *** SUB **
                                                                                                        ADD DISK TO FILE
       550 : ** SUB **
560 * ** SUB **
                                                                                                 DELETE A DISK FROM INDEX
       588 CLS:PRINT
598 INPUT WHAT IS THE NO. OF THE DISK YOU WANT TO DELETE ";DNS
688 WF=1:CLS:PRINT@348, WORKING . . . "
        618 FOR J=1 TO XX
       628 IF LEFTS(DNS(J),4)=LEFTS(DNS,4) THEN DNS(J)="ZZ":PNS(J)="ZZ"
638 NEXT J
648 CLS:PRINT@338.*DISK NO. -- ":DNS;" -- IS DELETED"
        650 GOTO 1450
         660 :
670 ' ** SUB **
                                                                                                          TO FIND A PROGRAM
         688 ' SCOTT THE TOTAL OF PROGRAM TO SEARCH FOR . . . "
        788 PRINT: LINEINPUT TIS
                                                                                                                                                                                                                                       Continued on page 20
```



FOR X = 15360 to 16383: POKE X, 191 – (PEEK (X) – 128): NEXT: RETURN. If the screen contains some alphanumeric characters, add "IF PEEK (X)<128 THEN NEXT ELSE" before the word "POKE". When graphics are stored in strings (in A\$), reversal would be:

1000 B\$:"": FORX = to LEN (A\$): B\$ = 6\$ + GHR\$ (191 - (A\$C(MID\$(A;X,1)) - 128)): NEXT

Also similar routines could be used to exchange characters for graphics and vice versa, exchange uppercase for lowercase and vice versa, or to use INKEY\$ to print graphics.

Marc Brumlik Computer Marketing Radio Shack Groveport, OH 43125

On Time Fix

In reference to the article "Soft Tach" (June 1981), I would like to point out that the program may hang up if the disk motor on time is less than the time required for 12 revolutions. The motor on time is nominally 2.6 seconds and the time required for 12 revolutions is 2.4 seconds at 300 rpm.

However, due to component tolerances, the on time may be shorter, and also the first revolution of the disk will be slower than 300 rpm.

An easy fix is to reduce the total number of revolutions. For seven revolutions change the 24 in line 90 to 14, and change the following lines:

230 FOR N = 1 TO 5 390 AV = RT/5

This will give an average of five disk revolutions.

David Cheney Lachine, Quebec Canada

An A for Alpha

I recently received excellent service from the Alpha Product Company.

I placed a telephone order and had the merchandise in a few days. It wasn't quite the right thing, unfortunately, so I returned the item. With equal speed, checks arrived for the refund and shipping costs. I was pleased by the service, speed and honesty. I will certainly look to Alpha for my future needs, and I'll recommend them to others without hesitation.

Robert A. Martin Albuquerque, NM

80 DEBUg

```
Program continued
 710 CLS:PRINT0335, "SEARCHING FOR : ";TIS:PRINT:PRINT
728 PRINTTAB(5) "TITLE"; TAB(20) "DISK":PRINTSTRINGS(34, "-")
800 :
810 * ** SUB **
                                                WRITE INDEX FILE TO DISK
908 : ** SUB **
                                               READ INDEX FILE FROM DISK
938 CLS:PRINT9128, "MAKE PREPARATIONS TO READ FILE FROM DISK"
943 PRINT:PRINT" WHEN READY -- GIT CENTER> . . ':GOSUB 1698
953 CLS:PRINT9348, "INPUTTING FILE FROM DISK . . . ':GOSUB 1698
958 OPEN ":,','DISKINDX"
979 INPUT11 XX:FOR X=1 TO XX:INPUT+1,DNS(X),PNS(X)
986 IF VAL(PNS(X)) : 99 PNS(X)=" "+PNS(X)
998 NENT X:CLOSE:WFF-8
1098 CLS:FRINT9335, "INPUT OF FILE FROM DISK COMPLETED."
1818 GOTO 1456
1028 :
1038 ** SUB ** SORT BY PROGRAM OR DISK NO.
1846 * "***
 928 1
 1050 CLS: PRINT@192, "SORT THE INDEX FILE BY -- :
PLEASE MAKE YOUR SELECTION . . . . "
1105 GOSUB 1688:IF AS="R" THEN RETURN
1110 IF AS= . "L" GOTG 1090
         : ** SUB ** OPTIONAL PRINT-OUT
 1140 '
1150 CLS:PRINTel92, "OUTPUT TO PRINTER (Y OR N ) 7°
1160 GOSUB 1630:N=0:1F AS="Y" THEN LP=1 ELSE LP=0
1175 FOR X=1 TO XX
1180 LS=LEETS(PNS(X),1):1.5S=LEFTS(PNS(X+54),1):IF MS=1 GOTO 1280
 1190 IF LS="1" GOTO 1280
1280 IF LS="1" OR LS="" PRINT"; ELSEPRINT PNS(X); TAB(13)STFINGS(6, "-"); "; LEFTS(DNS(X), 5);
1210 IF LSS="1" OR LSS="" OR X-54 > XX PRINT" ELSE PRINTTAB(36)
PNS(X-54); TAB(49)STRINGS(6, "-"); " "; IEPTS(DNS(X+54), 5) ELSE PRINT""
  1220 IF LP=1 AND PREK(14312) <>63 THEN CLS:PRINT#338, "PRINTEP NOT
 1220 IF LP=1 AMD PREK(14312)<>63 THEN CLS:PRINT@330, "PRINTEP NOT READY!":GOTO 1458
1230 IF LP=0 THEN GOTO 1270
1240 IF LS="1" OR LS="" LPRINT" ";ELSE LPRINT PNS(X);TAB(13)STRI RGS(6,"-");" ";ELFTS(DNS(X),5);
1250 IF LS="" OR LSS="!" LPRINT" ";GOTO 1270
1260 IF LS="" OR LSS="!" LPRINTAB(45)PNS(X+54);TAB(58)STRINGS(6,"-");
":LEFTS(DNS(X+54),5) ELSE LPRINT" "
1270 N=U+1:IF N=>54 THEN N=0:X=X+54:IF LP=1 LPRINTSTRINGS(12,13)
  1288 NEXT X:GOTO 1458
 1396 ' ** SUB **
                             3 ** LIST DISK ID'S IN INDEX FALS
  1310 CLS:FOR X=1 TO XX
1310 IF PNS(X)=":" THEN PRIGT DNS(X) ELSE 1356
1340 IF PEEK(14312)=63 LPRINT DNS(X)
  1340 IF FEBRUARY TO DEFEND OF THE -- TO RETURN TO MENU, HIT (ENTER) GOSUB 1660 RETURN 1378 : VIEW A DISK'S DIFECTORY
   1400 CLS:PRINT@320,""; INPUT"ENTER DISK NO. YOU WISH TO REVIEW "
                                                                                                                                 Program continues
```

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80 DEBUg

companies advertising in the major computer magazines—keep looking! The May 1981 80 Microcomputing does not state on the parts list that all TTL devices must be of the low power Schottky type (74LSXX series). If you do not use low power devices the TRS-80 power supply may not be able to cope.

Next, whether your system has 48K of memory or not, disregard the section pertaining to the memory disable option. Instead use the technique shown in Fig. 1.

Paul C. Fowler, Jr. Enable Electronics 2103 Charlton Lane Radford, VA 24141

High Addresses

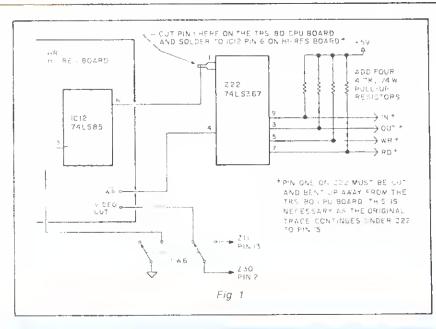
An apology is due readers with 16K systems who tried the demo program in my article "Program Chaining and Loca! Variable Definitions in Basic" (June 1981 p. 255). Despite considerable thought given the selection of addresses for the start of variable storage, I failed to heed the advice in my own article and set one of them too high. Consequently when run in a 16K system the stack overwrites part of that variable storage area and the program bombed. It runs OK in systems with more memory.

A quick fix is to change the number 32500 to 30500 the four places it appears in the listing (Lines 120, 170, 230 and 1010). The program will then run on any size system.

Hal Brown 643 W. Valley Forge Road King of Prussia, PA 19406

Everyman's Debug

i typed in "Everyman's Mod II Word Processor (July 1981) on my Model III. Everything works well with the following exceptions: To fix faulty video display during edit insert mode, change the end of line 1080 to read:—:PRINT @ C+1, B\$;A\$+R\$



Since Model III doesn't have tab or backspace keys, and does not recognize the up arrow, change line 180 to read:

180 (F A = 62 THEN 430 ELSE |F A = 91 THEN 330 ELSE |F A = 60 THEN 310

This lets you use "<" for the left arrow, ">" for the right arrow "Clear" for the down arrow, and the up arrow as in the text. If moving the fine to the right chops off the last character, delete the + from line 1200.

If you use an Epson MX80 line printer, lines 1661 and 1662 will have to be changed to accommodate its charl inch and lines/inch format.

1661 IF G = 5 THEN W = 14 ELSE IF G = 10 THEN W = 18 ELSE IF G = 16.5 THEN W = 15 1662 IF H = 6 THEN T = 50 ELSE IF H = 8 THEN T = 48 FLSF IF H = 10 THEN T = 49

Howard Potvin 2527 S. Los Padres Drive Rowland Heights, CA 91745

DEBUg

The Real Thing

What! Another correction? In August's 80 Input, I commented that Frank DiNunzio's joysticks might cause bus contention if used during a CLOAD. That was true, but between my drawing errors compounded by drafting errors the fix that was described would end up being worse than no fix at all. Fig. 1 and Fig. 2 are the real thing.

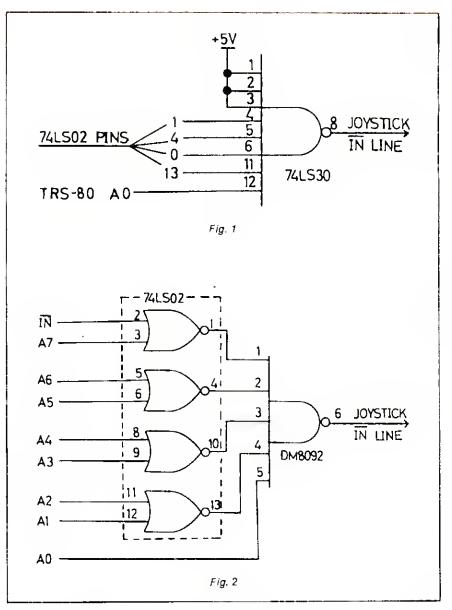
Dennis Kitsz Technicał Contributing Editor Roxbury, VT

Joysticks Damage Hardware

As Technical Contributing Editor for 80 Microcomputing, I am often called on to review hardware manuscripts before their publication. Frank DiNunzio's article on joysticks (June 1981) was such a case. I contacted Mr. DiNunzio before the article was published pointing out my concerns, to which I received a response similar to the one printed in September's Input. I reviewed the erticle again, and came to the same conclusions. Since he did not wish to incorporate a protective port-decoding circuit in the joystick design and since I believed this would be a very popular project, I prepared e postscript to the article.

For a time, the Keystone Kops syndrome set in. Due to magazine madness, the postscript disappeared and the article was published without it. I sketched out a hasty replacement; unfortunately, I made a mistake in the drawing, later compounded by a drafting error, which completely garbled the so-called improvement (please see this month's Debug). Mr. DINunzio's rather harsh response to my suggestions then appeared.

If this were a minor theoretical disagreement, I would shelve any response in order to avoid an unseemly and typically mundane war of letters to the editor. But the user's investment in a computer is considerable, so I want to answer Mr. DiNunzio's letter point by point.



First, I understood that the joysticks were meant to be used only with "a sultable program to draw or play games." However, it is unwise and chancy to plug something in when the computer is on, and user manuals for all computer peripherals—including Radio Shack's own—warn you to turn your equipment off before connecting them. Since it is important that any peripheral be plugged in when the power is off, Frank's joysticks would be in and on when CLOADing such a suitable program.

That brings up a related comment I probably should also have made earlier. Using the TRS-80 bus connector—pins 37 and 29—to complete the circuit that powers the joysticks puts the computer in Jeopardy. Plugging the board in on an angle can run a hazardous 6 voits through

other components of the system. So put a switch on the joysticks, too.

Second point: Frank says "INP(1) will not open the cassette port; INP(225) does that." Absolutely right. But the converse is not the case, since opening the cassette port will also open the joysticks. So will input from 240,241,242,243,244,245, 246 and 247 (Exatron Stringy Floppy), input from 232, 233, 234 and 235 (RS-232 Interface), Input from 208 and 209 (Microconnection), input from 127 (Micromouth). and so on. I save the chain programs of ESF, and it cannot be plugged or disabled without wiping out a loaded program or program sequence. And removing the RS-232 unit means disconnecting the expansion interface (killing a disk system) or opening the cover and removing the RS-232 board before proceeding.

Mr. DiNunzio's statement does bring up an interesting question: Why would INP(255) cause the joysticks to open while on the other hand INP(1) does not cause the cassette port to open? That is because INP(1) is a hardware illusion created by software; as I stated in my first comment, any INP statement from INP(0) to INP(255) will trigger these joysticks. Mr. DiNunzio uses INP(1) simply because specifying that port number will avoid simultaneously triggering the cassette input circuitry.

Third point: "Hex inverters...pull some of the data lines down to ground potential; this is also done by the keyboard and all other input devices, and is not harmful to the computer." That's true, but all the devices he mentions pull data lines down only when specifically asked to do so by port or address number. Frank's joysticks pull data lines to ground even when not asked to by proper port number, and that is harmful to the computer. Why is It harmful? Because digital electronic devices can have three states: on, off, and a third state of electronic invisibility. To avoid electronic chaos, only one device may be permitted to respond to a central processing unit's request for information. In cases where bus conflict happens accidentally (which will never occur in a properly designed circuit), the low (ground, or "zero") signal takes precdence. But while it is low, it is also causing additional current to flow through any circuits which may be in a high (5 volts, or "one") state. That's what the third state was designed to avoid, which should have been used here. The unorthodox method used by Mr. DiNunzio to turn on the 74LS368's is a partial attempt to provide this invisibility, though 74LS366's (with two enable lines) would have been a better choice in some ways. Though unusual, his method can extend battery life.

To provide signals only when needed, then, every device connected to the computer should be decoded; that is, it should have a specific address or port integrated with it. In that way, only one device is "visible" to the CPU, and no peripherals or memory compete with each other. These joysticks do in fact compete for attention, may respond unexpectedly, and (I repeat) may eventually damage the computer.

Fourth point: When I was reprimended that "241 is the lowest data number the circuit develops," I checked the original article once again. Actually, the lowest data number produced is 240, as Frank points out in his abstract numbers; rather, they work in digital signals whose actions can be made to simulate decimal num-

bers. Thus, though 240 is not a decimal zero, that is irrelevant; it is binary 11110000—which means four of the eight independent data lines are pulled to zero, and can conflict with active computer data during other input. Readers can take a lesson here in the dangers of thinking in decimal numbers when binary concepts are being implemented; merely because 240 is not zero, it does not follow that the binary condition it represents has no components which are zero. The possible configurations of Frank's Joysticks Include several zeros in the lower four lines: 0000, 0001, 0010, 0011, 0100, 0110, 1000, 1001, 1100, and 1111. Nine of the ten combinations present bus contention problems.

Fifth point: Frank states that an AA cell "in theory... is 1.5 volts, but in reality it provides somewhat less voltage." In reality, depending on how new it is, an AA cell can provide *more* than 1.5 volts (as well as less), even under the minimal load demanded by the joysticks. However, I will grant his point that most of the time the voltage will be less than 6 volts. Nevertheless, fairly new alkaline cells will still provide more than 5.25 volts, the maximum operating supply voltage. Here are excerpts from the manufacturer's data sheet on the same integrated circuits specified by Mr. DiNunzio for this project:

"Operating Conditions. Supply Voltage: (min) 4.75 (nominal) 5.00 (max) 5.25. Absolute Maximum Ratings. Supply Voltage: 5.00. Note: Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or at any other condition above those indicated... is not implied."

For greatest reliability, I would recommend readers use the simple regulator circuit I suggested (80 Input, August 1981, page 18) with five AA cells rather than four; this will prevent the regulated voltage from dropping below 5 volts too soon, giving the appearance that the batteries have gone dead early.

To Mr. DiNunzio's final provocations, I decline to respond. I will say that even if readers do decide to follow his design as printed, at least this exchange of correspondence and commentary should illuminate how different designers approach a task, and how hardware reliability can be increased. As I stated in my original letter, I did not intend to be hard on Mr. DiNunzio; I'm sorry he was offended, but I hope readers know that they are my first concern. It is they who have to face the consequences of what they build.

Dennis Bathory Kitsz Technical Contributing Editor Roxbury, VT

'Know-it-All' Goof

The program "Know-it-All" (May 1981, p. 288) is a very useful program but is not complete in every detail. First, there is an error in line 65035. The items between the brackets should read (65536-U).

Second, if there are any alpha data lines these will be decoded as a register and to eliminate this, insert OR T=136 after T=0 in line 65055.

Third, in program statements such as ON X GOTO 100,200,300, line referencing program only picks up the first line 100 and not lines 200 and 300. To overcome this, type in place of line 65150:

65150 NEXT:RE = 0:C\$ = ""GOSUB650:IFT = OTHEN65045

65152 IFT = 320RT = 44THEN65130ELSEGOT065050 With these additions the program becomes very useful in debugging lengthy

programs.

Brian Heywood, chief engineer

Taranki Electric Power Board

Eltham, Taranaki

New Zealand

Retrieving Block Cursor

I read the article on "Block that Cursor" by Ron Balewski in the April 1981 issue and noticed that if I tried to relocate the program to a location high enough to use my 48K of RAM I would get an "OV" error from BASIC. Evidently the problem is in the integer arithmetic that is used by the PEEK and POKE statements. While the Z-80 can handle addresses greater than 32767, the TRS-80 integer arithmetic cancer.

Fortunately, there is a way out. You can use the block cursor and your additional memory. It turns out that if you subtract 32768 from the 16K POKE locations the TRS-80 two's complement arithmetic will come up with the appropriate addresses for the POKEing. This is done on line 30 in the program below. Of course, the new memory size will be 65402, and you must change the location that will be referenced by Basic, which is done as follows:

- 5 'GLOCK CURSOR PROGRAM FOR 48K RAM SET MEMORY SIZE TO 65402
- 10 FOR K = 32635 TO 32654
- 20 READ X
- 30 POKE K 32768,X
- 40 NEXT K
- 50 OATA 245,197,205,88,4,237,75,32,64,10,254,95,32,3,62,143,2,193,241,201
- 60 POKE 16414,123
- 70 POKE 16415,255
- 80 ENO

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"Mr. Baker has some unique ideas compared to others involved in software production."

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by Ronald Bobo

fter successfully making backup copies of Acorn's "Pinbali" and Microsoft's "Adventure" (both of which are on copy-protected diskettes), I next turned my attention to those annoying security diskettes that accompany programs from The Bottom Shelf.

Mr. Baker has some unique ideas compared to others involved in software production. To quote from the Trakcess manual, "Congratulations! You have just purchased the most powerful TRS-80 disk access utility yet written. Perhaps you were able to share the cost with a few friends, but even if not I hope you will find Trakcess worth the price."

Baker credits William Barden's Disk Interfacing Guide for the TRS-80 as inspiration for this program and recommends it to help you use Trakcess efficiently. The non-expert should also have a copy of the data sheet on the 1771 floppy disk controller chip. A copy can be found in the Expansion Interface service manual or may be obtained from Western Digital. National Semiconductor, a second source for the chip, also has a sheet available.

Trakcess requires a 48K TRS-80 Model I. The (C)opy and (D)uplicate commands require two disk drives.

The program is in two parts on the disk—Trakcess, a Basic program, and Trakcess/CMD a machine-language routine. Typing 'Trakcess' and pushing Enter will load the machine-language section, and from there on prompts are given.

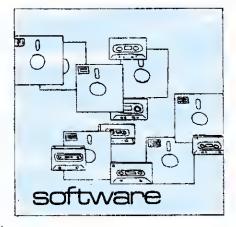
Printer output is available, but a printer is not necessary.

Trakcess contains all its own disk I/O routines. If the program stops on an error, however, a DOS disk should be inserted in drive 0 before continuing, to prevent possible system hangup.

Everything is menu-driven. Disk-related commands will not work until a drive is se-

lected and activated. Upon selection, you will be asked for the head position of the drive. Press Enter; the default value is zero, and the head will be positioned at that track.

Typing I steps the head of the selected drive in one track (toward the center of the disk) and O steps it out. These two keys repeat if held down. Trakcess is programmed for thirty-five tracks, but Instructions are furnished for changing this if necessary.



G followed by a decimal number allows quick positioning of the head at any desired track.

R and W allow reading into a specified block of memory, or writing from it. It is fessible to modify the data before writing back to disk, making the reconstruction of a damaged sector possible. All sector writes are verified by rereading, so data transfers are reliable.

T and P (Take and Put) allow the taking from or putting to disk of a whole track (about 3120 bytes) in one operation. A track may be read in, then scanned with Trakcess' editor to reveal everything on the track.

B (Bulld) is a very powerful command. It allows you to tailor a track to your own specifications, with no restrictions other than overall length. As many as eighty different sectors per track may be specified, of different lengths and types, with any

names. Once the track has been created it may be edited in memory before writing It to disk, with the P command. For example, you might zero out the DAM (Data Address Mark) for a short sector, thereby generating a false sector ID. Or you may remove the ID CRC to get a false ID pack or the sector CRC for an always-bad sector. Make your own protected disks, anyone?

Typing S causes the current track to be scanned for useable sectors. All the important information (track number, sector number, sector length, whether or not a sector is IBM format, and the data address mark) will be determined and displayed on the screen or printer. This process is not fast; thirty seconds may be required to scan a track. If the track has any false sectors, this will be noted. L (Locate) scans the full disk, tells you which tracks have sectors, then offers you the option of a full report.

C will search the current track, build a matching format track in memory, then write it out to a target disk. Subsequently, it will transfer (and verify) all the sectors. If any sectors are damaged or of undeterminable length, you will have to specify one. Unless you know what it should be, do a track read and look at the sector in memory. Try the next larger multiple of sixteen bytes than the sector's apparent length. For this and the D command, you must have two drives—you cannot copy to the active drive.

D is essentially the C command repeated for each track. Most disks, whether protected or not, can be duplicated in about thirteen minutes. The disk you're copying need not be formatted, but it's a good idea to format it to make sure there are no bad tracks. It may then be bulk-erased before copying.

E is a scrolling editor utility. Memory may be edited, or memory between specified addresses may be filled with a specified byte. The arrow keys move the cursor, and scrolling is accomplished with shifted up and down arrows. Memory may be displayed in either hex or ASCII. In either mode, whatever you type will be put into memory at the cursor location.

F calculates the two CRC bytes for any block of code in memory, or for any bytes

THE ALPHA I/O SYSTEM

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THE INSIDE STORY

If happened 3 years ago, when our President made a docision. At the time we specialized in custom analog and digital circuit design. The decision was to attempt to develop a line of standard interface hardware for the emerging microcomputers. At the time (1977) we had to decide which of the new machines could become the "industry standard" of the low cost micras

Despite a few aggravating but minor deliciencies, the TRS-80 seemed tohave the most chance of success and it had the best price/performance ratio. Also, with some imagination, their large sales organization could become the largest service network in the world, a reassur ing throught for the many novices in this new field

If became clear that the TRS-80 could be used (with our then hypothetical system) to solve prodlems in many fields where computers were not yet used, mostly because of their high cost. The IDEA was simple! ALPHA PRODUCT would supply the missing link between the TRS. 80 and the "outside world", [more about this "outside world" later).

Early Survival

GANGER! If Radio-Shack entered the same market, we probably would not have survived, but the expectation was that they would be too busy developing their basic line (drives, printers, modernield.) Thanks to our more specialized products, we would not be competing with them 8A0 STARTI We began with a failure. Our first product was supposed to be a simple, low cost, general purpose device. If would allow the TRS-80 to accept inputs other than the keyodard. Many kinds of external devices (the "outside world" mentioned before) like photocells. sensors thermostats, switches, contacts, etc., could be connected easily. In addition, there were two relays to control (on or off) external loads such as motors, tamps, appliances, nexters, etc., etc., in other words, it would allow the computer to interact or interface with external devices. We called if the INTERFACER 2. What a mistake! It sounded too much like expansion interface. Many enthusiastic TRS-80 users called thinking that our "INTER-FACER 2" was a low cost Expansion Interface (al \$85 that would have been a real bargain!) We wanted to change the confusing name. That meant reprinting the manual, changing the adscrapping the flyers, discarding the silk screened cases. Well: "INFERFACER 2" it would

TROUBLE! We also found that the majority of TRS-80 users were AFRAtO of the hardware. They could be very comfortable with fancy programming but thought you had to be a computer specialist or technically inclined to put the INTERFACER 2 to work. In truth, some IMAGINA TION and a SCREWORIVER is all you really need. Anyona able to wire a switch could use this device

WORSE! There was also the fear of plugging a "foreign device" into the precious computer This notion has all but disappeared as there are now so many quality products designed for the TRS 80 that plugging in a non Radio-Shack device has become common

Our ad in Creative Computing (80 Microcomputing did not yet exist) hardly paid for itself



We had a decision to make. Were we wrong or just too early? Our first INTERFACER 2 was sold to someone willo wanted to, and succeeded in, controlling his tancy model radroad with his TRS-80. Interesting, but what made us stick with the concept was that some of our INTER-FACERS began finding use in applications with tascinating possibilities. Space is tacking to describe them, but the most exciting was the successful use of the system in assisting a handicapped young boy. We were pleased to hear of such a meaningful application.

Today

Three years later, as you can see in our ads. The INTERFACER 2 is alive and well. The price went up a bit, and despite the infroduction of the more powerful INTERFACER 80, the sales have been steady

Then came the least understood product! the ANALOG 80. This \$139, nicely designed module is an Anatog to Digital converter with 8 input channels. Used with your TRS-80, it provides a powerful "data acquisition system". This jargon simply means that you can monitor, measure and record B independant varying voltages. Very lew people realized its real power. Such a system would have cost over ten thousand dollars just a few years ago

The possibilities in scientific and engineering environments are endless. This system could replace chart recorders, digital data recorders, programmable calculators, data analyzers. and many other specialized and expensive pieces of equipment. Furthermore, up to 8 ANALOG 80's could be used simultaneously for a total of 64 channels of analog input! They simply plug into the TRS-80 using our - X - series of bus extenders (EXPANDABUS)

The idea was simple. We would supply the missing link between the TRS-80 and the 'outside world"......

Our next product was to be a second generation, Imput/Output interface, with more flexibility than the INTERFACER 2. Careful design and refinement yielded the INTERFACER 80, the most powerful real world interface on the market today. It has 8 inputs, each optically-isolated and 8 outputs, each with a relay contact. The INTERFACER 80 is fully compatible with our ANALOG 80, allowing these to be used together in order to create systems that control

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The following pages contain more information about the devices mentioned here. We invite you to call or write to discuss your particular application

Device descriptions; NEXT PAGE 📥



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WHY LOSE PRECIOUS TIME?

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- *TIMEDATE 80's small size keeps the computer table unclullered. If you have an Expansion interface, TIMEDATE 80 literally "DISAPPEARS" by slipping into the empty space in the bottom of the interface
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80 REVIEWS

typed in. Useful when examining damaged or tricky sectors, the CRC may be regarded as a two-byte checksum. The disk controller starts calculating a CRC whenever an address mark of any kind is encountered during a track write, and whenever a sector is being written or read. On a write, these go to the disk and on a read they are compared to the CRC bytes on the disk, then reported back to the CPU along with an indication of their correctness.

H gives a choice of hex or ASCII dump to the printer starting at any memory address.

According to the manual, possible tu-

ture additions to Trakcess are a disk compare and a disk search facility. Improvements are promised to keep up with the state of the art in protected disks. An upgrade to the latest version may be had at no charge by sending a diskette with a postpaid mailer to The Alternate Source. Presumably, you would also have to furnish proof of purchase.

Mr. Baker says he doesn't like protected software because it makes modifying or moving the code difficult, and it is usually a pain to back up and use. Baker maintains that, with 300,000 or more TRS-80's in the field, and the fact that relatively tew owners are in close contact with large

numbers of other users, and that most owners are willing to spend some money on software, there will be plenty of sales potential even after all the swapping.

Whether or not you agree with Mr. Baker's philosophy, it should be pointed out that reproducing copyrighted software for other than your own use is illegal.

Trakcess is a good program, it works and, though not a replacement for Superzap or similar programs, it can be used for purposes other than copying. Besides that, it will give you a mini-education on the working of the disk controller and the various disk tormats possible.

Hellfire Warrior Autometed Simulations Mountain View, CA \$39.95 disk, 32K TRSDOS \$39.95 cassette, Level II, 16K

by Dabre Mershall 80 Microcomputing steff

elifire Warrior is the second in the Dunjonquest series of full-length fantasy role-playing games produced by Automated Simulations (the first is the Temple of Apshal).

The game is structured much like Datestones of Ryn, the minigame introduction to the Dunjonquest series. Like Datestones, commands are issued by pushing various single keys. Graphics on the '80 consist of a single-dimensional top-view representation of corridors and rooms found in the cave you venture into in your hero's role. The character appears on the screen as a triangle created from graphics pixels, treasures are rectangles, and critters and nasties apppear as squares of different sizes, which disintegrate into shooting rays when they are defeated.

Hellfire Warrior consists of four levels of dungeon. Each level proves increasingly harder to stay alive in. However, experience points are gained with each nastle killed, and your character becomes stronger, more resilient and harder to defeat with each battle.

This game is perhaps unique in the fantasy game field because you have the option of creating your own character or bringing a favorite character from any other role-playing game, computer-based or otherwise, with you to Hellfire to be your hero. The Gamemaster will randomly select a hero's attributes for you if you do not choose to create your own character. Either way, you must name your own character, and I quickly discovered the name

must have a hero's ring to it, or the program has some distinctively reprimanding thoughts to share on the subject.

You may increase your character's native attributes (and chances to stay alive) by visiting and spending your money at the Armory, the Apothecary Shop and the Magic Shop. Each shopkeeper has many things of various import for sale. and you should choose carefully, because the weapons, armor and magic you provide your hero will greatly affect his chances of remaining alive in the dungeon. Each shopkeeper sets a price for his goods and is open to haggling, within reason. If you haggle too much or offer too low a price, you may find the shopkeeper raising his prices. Weepons may be enchanted, indeed, should be enchanted; elixers, nectars, bloods and salves are avallable in plenty, but without any explanation or guarantees as to their desirability; magic amulets and talismans are also available to the wealthy (read: successful) adventurer.

The object of the game is simple: Wander through the maze, collect all treasure on all levels, buy advanced magical alds, proceed to higher levels, and eventually rescue the warrlor mald Brunhilde held enthrailed deep in the dungeon. Exit the maze with Brunhilde, treasure and body intact, and you win. Oh yes—pay the cleric and try not to get yourself killed. While resurrection is possible (and even likely), you always seem to lose a lot in the process. Provisions are made for saving a game or character.

Frankly, one of the most enjoyable things about this game is the Book of Lore. It is nicely illustrated, slickly presented and makes for enjoyable reading, which is saying a lot for something that is software documentation. The directions and explanations are thorough and explicit; you will be well-advised to read the

book completely before attempting to play the game. There are room and treasure descriptions, and some secret messages that come in handy. In addition, there is a short scene-setting story that proved to me the people who wrote the documentation are game players and fantasy lovers.

The game proceeds in much the same way as Datestones: You manuever down halls and into rooms searching for treasure and secret doors. At any moment, you may be attacked by a nastie or beastle and have to defend yourself. There are pits and traps, and any treasure box may be boobytrapped.

The game is written in Basic and unfortunately, this makes for slow graphics drawing and reaction time; you may continue tighting a battle after you have demolished your opponent because of the slowness of program execution. It is also difficult at times to determine exactly who is coming out ahead in a battle. Unlike the Datestones game, however, critters in this contest do not self-destruct without any effort on your part. In addition, the game is the real time, so don't let your attention wander; you may discover you have been killed while you ran out to the kitchen to get a snack.

The game is not easy to win. The beastles change types on each level, different magic is required, and there is enough going on when the graphics eren't being drawn to keep your interest up. Some of the graphics sections were poorly conceptualized; when it takes many seconds to draw a dungeon section, I don't want to have to watch it being done every three or four steps I take, which occasionally happens. On the whole, however, any true game fanatic will find this game intriguing and entertaining. It is also a welcome change from adventure games without graphics.

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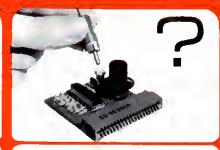


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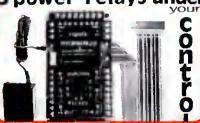


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IBM and all the biggies are using green screen monitors Its advantages are now widely advertised. We feel that every TRS-80 user should enjoy the benefits if provides. But WARNING all Green Screens are not created equal. Here is what we found

·Several are just a flat piece of standard colored Lucite. The green tint was not made for this purpose and is judged by many to be too dark. Increasing the brightness control will result in a tuzzy display.

Some are simply a piece of thin plastic him laped onto a cardboard frame. The color is satisfactory but the wobbly him gives if a poor appearance

One optical lifter is in fact plain acrytic sheeting.
Fatse claim. A few preferd to lifeduce glare. In fact their

flat and shiny surfaces (both likin and Lucite type) ADD their own reflections to the screen

4 tew laughs. One at claims to reduce scient contrast. Sorry gentleman but it is just the apposite. One of the Green. Screen's major benefits is to increase the contrast between the text and the background

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Lisp Interpreter Supersoft Associates Champaign,IL \$75 cassette \$100 disk

by Gary McGath

n unusual entry in the language field is Supersoff's Lisp interpreter. Lisp is not as well known to microcomputer users as it might be, although it is the most heavily used language in artificial intelligence research. Its simple (though unusual) syntax and powerful data manipulation capabilities make if an excellent choice for dealing with the complicated data structures required by artificial intelligence programs used for natural language processing and pattern recognition.

Other areas where Lisp is effective are symbolic mathematics and adventure-type games. The Supersoft interpreter runs on both the Model I (Level II) and the Model III with 16K of memory; the disk version runs under TRSDOS. All these versions offer TRS-80 owners the opportunity to experiment with artificial intelligence-type programs on their microcomputers.

Lisp stands for List Processing. The only data structure Lisp uses is the list, which is a series of linked data cells. The elements of lists may be other list; this permits the representation of any tree data structure. Programs are lists and may create other lists; memory space for lists is allocated by the interpreter as needed. As a result, it is possible for one Lisp program to create or modify another one.

Supersoft's implementation of the language is fairly complete. Floatingpoint numbers are used, and a variety of mathematical functions are provided. Variable names (atoms) may be of any length. Property lists, allowing the program to associate attributes with atoms. are supported, as are two different kinds of user-defined functions. Functions that are part of standard Lisp, but can be composed easily from other functions, have been omitted to save space. The user's manual gives Lisp definitions for these functions which can be typed in. The set and reset functions permit screen graphics.

Input/output operations on cassette and disk consist of saving and loading all data are not formally distinguishable.) On the Model III, either 500 or 1,500 baud may be selected for cassette input/output but the rate cannot be changed once it has been set. This limits the Model III user to 500 baud if he or she wants to use the

Edit and Trace programs Supersoft provides of tape.

The interpreter is quite fest and nearly bug-free. Garbage collection—the reclaiming of released storage—is the most difficult problem in implementing Lisp; but in this case, the hesitation caused by the garbage collector is berely noticeable, even on a 48K machine.

I have found only two bugs so far in the cassette version. One is typing an atom at the interpreter will not produce a response unless the atom is followed by a space or a right errow. The other is if an atom is given a property of NIL, that property can never be changed except by directly modifying the property list.

There are, however, a couple of disappointments in store for the buyer of Supersoft's Lisp. The manual is a thin document, typewritten and cheaply bound. It will be an insufficient guide for anyone, even a professional programmer who is less then fluent in Llsp. It does, however, tell the experienced Lisp programmer everything he needs to know.

The major deficiency in the software itself is the tack of any printer output. The only way a printout can be obtained is to save a program on cassette, return to Basic to redirect screen output to the printer, reload the program, and obtain the listing. If Supersoft had provided a POKE function like Basic's, this redirection could have been performed without leaving Lisp.

These problems, however, will not stand in the way of enyone who believes Lisp is the right language for his or her projects. I hope Supersoft will add some improvements in the future, but their product is already an exciting elternative to programming in Basic.

Ed. note: The Al references are our comments, not the author's.

Spooler Mumford Micro Systems Summerland, CA \$16.05

by William C. Huffman

pooler by Mumford Micro System is a print formatting system for parallel or serial printers. Spooler allows you to specify the number of lines per page, the number of characters per line and a pause, if needed, between pages of output. The pause allows insertion of another sheet of paper if your printer prints only one page at a time. Spooler also allows you to send the contents of the video screen to the printer. This last feature is similar to the JKL function of NEWDOS and others.

Works Without Disk

Spooler is a machine-language program which works on any Model I, Level II, 16K or larger and Model III 16K or larger TRS-80. Spooler will work without disk. Let me repeat that, Spooler works without disk. It is supplied on a cassette containing six copies of the program. Included on the tape are two copies each of the 16K, 32K, and 48K versions of the program. Directions for placing the program on disk are included in the easily read and well documented instruction booklet.

Spooler works by setting eside a userdefined chunk of high memory. All output intended for the printer is intercepted and sent to this area. Whenever Spooler is active and LLIST or LPRINT commands are encountered, the cursor disappears from the video monitor for a brief period. The printed output is rerouted to the reserved high-memory area. When the cursor returns to the screen, you are able to continue execution of your program. You may even load and execute another program while the printer goes merrily on its way producing printouts. The printer continues to run while you continue with your program.

Spooler also works while in DOS. Now you can get a printout of your disk directories if you do not have Newdos or one of the other operating systems with a JKL feature.

I like the indent function of Spooler. I tend to program using very long or multiple statement lines. It is difficult to follow a listing of a program which contains long lines because the line numbers do not stand out. I use Spooler to indent my listings and they become much easier to read.

My Centronics 779 line printer is slow and my Texas Instruments 810 printer will not indent listings. With Spooler, my welting on a printer is over. In short, I like Spooler, I like Mumford Micro. They sent me an improved version of Spooler several months after I received the original version. The Improved version was sent without charge and without my requesting it. I can only give my highest recommendation of Spooler and of Mumford Micro Systems.

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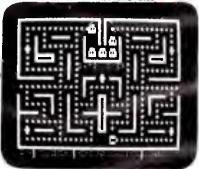
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EDTASM-Plus Mark Chamberlin and Bill Yates Microsoft Bellevue, WA \$29.95

by Chris Gundlach

ince the introduction of the TRS-80, those of us wishing to try our hand at Assembly-language programming have had the excellent Radio Shack Editor/Assembler which is well known as a good value because of its "big assembler" features. Unfortunately, using the original EDTASM meant writing programs with the Editor/Assembler, saving the source code on cassette (for later work), saving the object program on cassette, and finally loading the object program and T-Bug (two more cassette operations that cause loss of EDTASM in memory). For me, all the cassette flipping (and the usual hassles with wrong volume settings) took away a lot of creative gusto needed to work with a machine-level program.

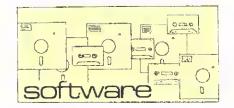
Microsoft's new EDTASM-Plus is one of those miracle programs that cures just about every hassle you might think of. If you are just starting to get into Assembly language and the inner workings of a TRS-80, EDTASM-Plus is just what you want.

EDTASM-Plus is written by Mark Chamberlin and Bill Yates; Chamberlin designed the original Editor/Assembler. These people know the TRS-80 inside out, and have been in touch with this computer since it first came out. The knowledge shows, since EDTASM-Plus is an incredibly complete Assembly-language development system oriented to the cassette TRS-80 user, and takes into account the overall design of the TRS-80, the way it uses memory, and so on.

EDTASM-Plus has three important parts and we'll review features of each for you. We'll try to explain things in a way that new Assembly-language programmers can picture. The three parts, all contained within EDTASM-Plus and loaded with one cassette load using System, are: the editor, the assembler, and Z-Bug (a debugging monitor similar in function to Radio Shack's T-Bug).

The Editor

The editor is very much like the same feature in the original Editor/Assembler. Using numbered program lines, it allows you to type in Assembly-language programs in Z80 mnenomics, or code words, such as the command LD A, (HL) which loads the computer's A-register with the contents of a memory location pointed to



by the H and L register pair. The editor stores these lines for later conversion, or assembly, into the actual numeric machine-level commands which the Z80 chip in the TRS-80 was designed to work from

Editing features in EDTASM-Plus have been greatly expanded over those in the original Editor/Assembler. Using a line-editing feature like the Edit function of Level II, you can change program lines. However, EDTASM-Plus also allows you to move any part of your Assembly-language program to another set of program lines. This saves you the headache of retyping one or several lines of assembler code after discovering you had them in a bad place in your program.

EDTASM-Plus' Editor also allows you to edit a given series of program lines without having to reenter the Edit function for every line. You just give the Editor the linenumber series and it stays in the Edit mode for each of the lines. Rather than giving the exact range of line numbers, EDTASM-Plus also lets you give a starting line number and a number of lines to edit—a handy feature to use after you've inserted new lines that might be numbered oddly.

Using a variation of this feature, you can also go through your program to add comments to each line. Called the extend function, it lets you move to each line, positions the cursor at the end of each line, ready to input your comment for the line. After you Enter the comment, the Editor moves to the end of the next line—you don't have to retype the Edit command and the X subcommand for each line.

EDTASM-Plus has the other program editing features of the original Editor/Assembler. For example, insert lines starting at a certain number with a certain increment, replace a line, renumber all the lines or a part of them, delete lines, find a string within the assembly code, and so on. Together with the new line, block copying and moving features of EDTASM-Plus, the new Editor is a powerful and versatile working tool for entering Z80 mnenomic code.

EDTASM-Plus also adds a couple of important features not found in the original Editor/Assembler, and which may be new to those familiar with original version.

It will accept macro definitions. A macro is something akin to a DEF FN statement in Disk Basic, by which you define a function that contains a number of actual program statements. When you call the function by name, the computer performs the steps of that function just as if you had written them out. Similarly, a macro is a block of Assembly-language statements that you might wish to use over and over again, but with different parameters or values within the routine. You define, or describe, a macro by writing out the steps using dummy values. The Editor remembers the steps in the macro, and whenever you call it by name and provide the values-a step involving a single program pseudo-op line—it generates the steps of the macro in your Assembly-language program when it's assembled.

EDTASM-Plus also allows conditional assembly. You may establish conditions that must be met for a given part of the program to become part of your assembled machine-language program, and if the condition is not true, the assembly just skips that part of the program as if it were not there. The example given in the EDTASM-Plus manual is a good one: You have a program you wish to assemble to tit a 4K TRS-80 and an extended version of the program to fit a 16K machine. Conditional assembly lets you pluck out the parts you do not want to include in the smaller program, so that you can create both versions using your master program instead of typing in and assembling two versions yourself.

"EDTASM-Plus is one of those miracle programs..."

EDTASM-Plus also recognizes new operators within you source mnenomics. Besides using expressions such as VIDEO + 40H, you can use multiplication, division, modulo division, and logical operators within your source code, so that the Assembler will calculate and assemble your program correctly without your having to work out the expressions by hand beforehand. You can also use parentheses in expressions, something that was not allowed in the original Editor/Assembler.

The Assembler

The assembler portion of EDTASM-

Plus is the part which reads your mnemonics and converts them to actual digital instruction for Z80. EDTASM-Plus provides a variety of error messages and warnings when your program is assembled, like the original Editor/Assembler.

But the original E/A left you with just a couple of options upon assembly—record the program onto a cassette to reload and run it, or continue working in the Editor. EDTASM-Plus will assemble your program directly into the TRS-80's memory, using a location you choose or one provided automatically by EDTASM-Plus, so that you don't have to record it on cassette to run and debug the program. Using Z-Bug (described next, and part of EDTASM-Plus). you can immediately run your assemblylanguage program. EDTASM-Plus gives you plenty of the interactive features that are inherent with a Basic interpreter, and eliminates a tiresome and often discouraging series of cassette loads and reloads just to test a program and get it right. This Microsoft package assembles into memory without destroying the Editor/Assembler itself, so you can go back to your source program in the Editor to make corrections and reassemble it to try again. Then, after the program is the way you want, EDTASM-Plus will assemble the program for loading into any memory location you specify, so that you can make your machine-language cassette and use the program without EDTASM-Plus.

The symbol table is alphabetized and error-codes are appended to listings in the symbol table for things such as undefined or redefined labels. Labels used to identify macros rather than actual source-program steps are also identified.

EDTASM-Plus supports lineprinter output, as does the original E/A, so that you can lineprint your source code with or without line numbers, the symbol table, the assembled listing, and so on. Switches (in-line commands given when you assemble the program) allow you to suspend or allow printouts of macros and other parts of the program.

Z-Buo

Z-Bug, the third part of EDTASM-Plus, is like a T-Bug whose IQ was beefed up by some miracle drug! Z-Bug is a monitor, a program that allows you to look into the TRS-80's memory location and change them if needed. You use Z-Bug to run your assembled machine language program, see what it does, make corrections and try again, set breakpoints, and jump back to EDTASM-Plus and the source program.

Z-Bug goes beyond T-Bug in that it will display program steps as mnemonics rather than simple byte-by-byte hex numbers. It's like a line-by-line disassembler and because Z-Bug stays resident with your source program and EDTASM, you can reference locations to be examined with Z-Bug using your own symbols rather than specific hex memory locations.

Z-Bug also has a calculator mode so you can perform hex-to-decimal conversion on-line (without disturbing your programs or entering special conversion subroutines) and even calculate expressions. You can ask Z-Bug, for example, to tell you where VIDEO + CURPOS + 40H is by just typing it like that, followed by = . Z-Bug will output numbers in hex, octal, or decimal, and will input numbers from the keyboard in any base from 2 to 16. You can therefore use Z-Bug to type in a memory location bit-by-bit (10011101, for example) and then see what that binary number is in hex, decimal, or octal.

A Byte mode lets you look at individual memory bytes (like T-Bug), and a Word mode lets you see pairs of bytes—properly decoded from the Z80's reversed storage format which has the low-order byte first. Z-Bug allows you to display memory locations as ASCII (character) output, too.

Z-Bug allows eight breakpoints in your program and you do not have to fix a breakpoint after it's reached, as you do with T-Bug. Z-Bug also allows you to step through your program by single steps which is a lot easier than trying to test a program on the fly at microsecond speeds.

Microsoft has included a stand-atone version of Z-Bug on the back side of the EDTASM-Plus cassette, so you can use Z-Bug atone. Symbolic references, of course, work only with a source program, resident with EDTASM-Plus, so the stand-alone version of Z-Bug can't reference symbols.

Z-Bug is great just for looking at the TRS-80's RDM subroutines and the program routines in the reserved RAM areas, so you can learn something of how Basic does what it does.

The EDTASM-Plus Hendbook

The instruction handbook is as excetlent as the software itself. It's written by William Barden, the author of Radio Shack's book on TRS-80 Assembly-language programming, thereby making EDTASM-Plus a fine companion to your first explorations in machine language. Some assumption of Z80 programming and the original E/A are assumed in Microsoft's manual, but all of EDTASM-Plus' new features are explained thoroughly and well. Microsoft even included a notice of a couple of obscure bugs that would arise in tricky assemblies, and tells you how to use Z-Bug to make the corrections to EDTASM-Plus and punch yourself a corrected tape. Needless to say, EDTASM-Plus obviously represents a huge amount of work by its programmers and Microsoft.

The Southeestern Texton Southeestern Softwere Birmingham, AL \$40, cassette Model !

by Dennis Thurlow

ind a need and fill it! Yep, those six words are the secret to success alright, and Southeastern Software has got a winner here! From the well written, indexed(!), easy-to-follow manual to the flawless execution of each and every command, this has got to be one of the best thought out packages I've seen.

The program locates itself to the top of available memory, then asks if you want to type in, or CLOAD, a program. Either way, when you're ready, you have an incredibly powerful editor at your disposal.

Using the shift key and down arrow as a control key, there are 24 cursor control commands that allow you to insert or delete characters, words, or lines of Basic,

search for any character, replace any character with any other, or load another program. The control X command puts you in an extended mode that allows eight more commands including string search and replace, block delete, insert lines with automatic numbering, and displaying the amount of free memory.

In addition to the text handling features there is an abbreviated keyboard. Pressing shift and any letter types a complete Basic command or statement.

The repeat key feature works for any Input not related to editor commands, the break key will abort a bad load, and the non-destructive cursor can be moved to any point on the screen using the four arrow keys. Complete error messages are displayed on screen and thoroughly explained in the previously praised manual, and programs can be merged in the buffer. When you exit the editor, all text is fed to a compiler that returns it to Basic compression codes.

This is a dream utility for the Basic programmer.■

Planet Miners Avelon Hill Beltimore MD 16K, Level II, Mode's I & III \$14.95

by Derren DeVigill

Planet Miners is Avalon Hill's first effort at a microcomputer game outside the strategic war genre, and is an excellent example of thorough programming. While Avalon Hill is a well established game company, I was a little leery of their excursion into the world of microcomputer game design.

planets); display mining status; display ships in orbit; display ship status (yours); set ship destination; protest a claim; attempt to claim jump; attempt sabotage; finished with commands for today (not exactly my idea of an option, more like death and taxes). When attempting sabotage or to claim jump, keep in mind that the Space Patrol may arrest you if you are caught in the act. If there are no Patrol ships around and your opponent catches you, your ship crew will be detained and tortured by your would-be victim. The scars still show, and I've become a wary miner indeed. (I told you it was realistic).

If you play with fewer than four players,

"While Avalon Hill is a well-established game company, I was a little leery of their excursion into the world of microcomputer game design."

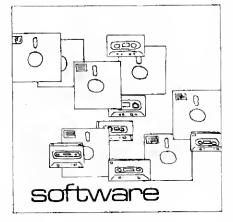
The game's scenario is a futuristic Gold Rush. You have five ships, three opponents, and a limited amount of mining claims to try for. To add realism to the game, the playing options include claim jumping, protesting claims, and (my personal favorite) sabotage.

The game is for zero to four players; zero being the computer versus itself. (The computer always plays in the capacity of the Space Patrol regardless of the number of human or non-human players). All the play options are interactive, for example, jumping a claim on Pluto causes the computer to evaluate the location of your ships, the Patrol's ships, and the claim holder's ships. It also evaluates the finesse of these ships, each player's political pull, and current popular opinion concerning your family. (Each player's ships are considered to be part of a corporate family.) Those factors concern not only claim jumping, but just about every aspect of the game, and its outcome.

I have noticed two detachments from reality in the game. One is that there are 10 planets in the solar system (the addition being Ceres), and two, once you set a ship's destination, you can't alter it (after take off), until the ship arrives. This adds a degree of spice in some situations.

There are 10 play options available: Large solar system (map); small solar system; display travel times (between the computer automatically assigns names to the other players, which are simulated by the computer. This may not seem like much, but I still hate the Lysanders—they win too much.

One game rule worth special mention is that just because someone types their name in first doesn't mean they will play



first—the sequence of turns is randomly chosen every round. This is the only program I've seen with this feature. Planet Miners is an exceptional buy.

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80 REVIEWS

TRS-80 Assembly Lenguage Herbert S. Howe, Jr. Prentice-Hell, Inc. Englewood Cliffs, NJ \$15.95 Herdcover, 188 pp. \$6.95 Softcover

by Edward D. Young III

earning how to write TRS-80 Assemblylanguage programs can be a very difficult task. Unlike Basic, in which the instructions bear a logical relationship to the operation intended, Assembly-language instructions usually resemble the names of exercises rather than computer operations. For example, you can Push or Pop a byte, Rotate or Shift a bit, etc. Hubert Howe, Jr., a columnist for the TRS-80 Monthly News Magazine, offers his book as a guide to understanding this complex, yet elegant, language. Except for the few reservations noted below, this book is a good reference for both beginning and experienced Assembly-language programmers.

Howe divides his book into two sections. Part I introduces and explains the basic concepts of Assembly-language programming. In addition to describing the operation of the Z80, the heart of the TRS-80, it explains the organization of the TRS-80's memory and how to use the various permanent subroutines which reside in it.

The discussion of how certain input/output devices, such as the keyboard and video display, are linked to special memory locations is particularly informative. Other chapters in Part I introduce the Z80 instruction set, the Z80 stack, and Radio Shack's Editor/Assembler program.

Howe assumes that the reader has ac-

books

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cess to a 16K Level II and has Radio Shack's Editor/Assembler or an equivalent assembler (such as the Apparat EDTASM which comes with NEWDOS +).

An assembler allows you to assemble and execute programs. If you do not have one you may still be able to load and execute the programs in this book by using POKE or by using a machine language monitor program such as T-Bug. In any event, the book will be clearer if you can assemble the sample programs and execute them on your own computer. This fact notwithstanding, the chapters in this section are clear, instructive, and a joy to read.

Illustrating Practical Tasks

Part II of the book illustrates the practical tasks that can be performed using Assembly-language programs. There are chapters on how to input and output data efficiently, read a cassette tape written in any format, move large blocks of data, and perform floating-point and integer arithmetic. Three chapters, however, are particularly outstanding. Chapter 15 describes, in great detail, how to use Assembly-language subroutines in conjunction with Basic programs. This chapter culminates in the presentation of a subroutine which allows the user to sort 100 alphanumeric strings in less than two seconds!

Chapters 16 and 17 discuss disk input/output and disk files. Chapter 16 contains a concise explanation, in simple terms, of how a disk is formatted and accessed. It also points out errors in the documentation of TRSDOS. Chapter 17 reveals how to store and retrieve information from seven different types of disk files. This chapter alone is worth the price of the book. Using the information contained in this chapter you can read virtually any disk, even one protected by a password.

On the negative side, a glossary and index are notably absent from the book. Both of these items are important in an introductory guide, since beginners cannot be expected to retain everything they read the first time through. A reader trying to find the definition of "two's complement", for example, must thumb through the book before discovering that the definition is on page 85. Also, there are a number of typographical errors in the book-a minor distraction. Finally, this book is not typeset in the usual manner. Rather than using the easy-to-read typeface found in most books, the author proudly announces that this book was composed and printed using a Diablo Hy-Type I printer with a Model I. The author probably thought that it was a good illustrative example to use a computer to write a book about computers; I found the print hard to read.

Nevertheless, I think this book will prove valuable to TRS-80 owners. It is written specifically for the TRS-80; it takes advantage of the short-cuts and features designed into the '80; and it provides helpful hints of practical importance to programmers.

The Nature of Computation:
An Introduction to Computer Science
Ire Pohl and Alan Shews
Computer Science Press
Rockville, MD
Herdcover, 386 pp.
\$18.95

by Joel Benjamin

The Nature of Computation: An Introduction to Computer Science is a rigorous introductory textbook to computer science and is for anyone just beginning in the field.

The authors have used preliminary drafts of this book as the text in college classes over the past ten years. They state their objective is to provide the following:

- 1. A survey of the field;
- 2. Initial literacy of the language and

methods found in computer science, and;

3. A historical, philosophical, and social perspective.

The authors have succeeded admirably in achieving these goals.

Algolic

The book has been organized logically and coherently. First, we are presented with a taste of what programming is like with the use of a machine-independent, high-level language known as Algolic. It is similar to Pascal and is particularly suited to expressing and executing algorithms. A number of well-known algorithms are examined, and we are shown how to express them in Algolic.

An Account of Techniques

We are then treated to an interesting

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80 REVIEWS

account of the development of computational techniques from the abacus to the intricacles of the structure of a modern computer. Along the way, number bases, floating point numbers, strings, arrays, Boolean algebra, hardware components and circuits, digital logic, and computer architecture are all presented and explained in a remarkably lucid fashion.

Programming languages and operating systems are then explored. In this section we get an insight into the relationship between high-level, Assembly, and machine languages; the use of compilers, interpreters and assemblers, and the various

examples of different languages suited to particular programming needs.

Next, the authors introduce us to the theory of Turing Machines, computability and algorithms.



The book ends very appropriately with a discussion of the social and ethical questions raised by the various ways in which computers are used in our society.

There is a set of comprehensive excercises and questions at the end of each chapter as well as suggestions for additional readings. These aids, along with the comprehensive nature of the text, make The Nature of Computation ideal as a text-book in an Introductory college course. But it can also be used by an Individual who wants a painless and clear introduction to computer science, which can be read on his or her own.

DIP-81 DIP, Inc. Boston, MA \$499

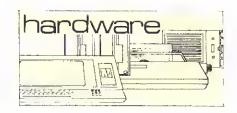
by David Tinis

side from the computer itself, the single largest purchase a hobbyist makes is a printer. Just one year ago a usable impact printer retailed for at least \$1,000. But that is changing. By flipping through the ads in any of the magazines It's evident that a printer price war is raging. With that in mind, I went out to find a low-cost, reliable, well built printer. I finally settled on the DIP-81. It seemed to offer the best value for the price.

The DIP-81 is an impact printer capable of printing 100 characters per second bidirectionally on an 80-character line. It can use rolls, fantold or single sheets up to 8.5 inches wide. Paper feed is by friction roller only. The normal print mode is a 7 by 7-dot matrix but can be expanded under software control to a 14 by 7 matrix.

The DIP-81 is not a marvel of advanced technology. It uses proven parts to accomplish a simple task—print. The unit is built on a steel chassis to which all subassemblies attach. Covering it is a single-piece shell of durable plastic. The funny bulge on the right covers a cooling fan that directs air over the electronics and the print head. The print mechanism is manufactured by the Two Day Corpora-

tion and uses a single ac synchronous motor to drive both the print head and paper feed mechanism. The print head itself is a seven-wire design that has a rated life of 100 million characters. I was already familiar with this print head when I started looking at the DIP-81. The rest of the mechanism is rated for 10 million lines of printing.



NORMAL 80 CHARACTER 10 FITCH

!"#\$%%(()*+,-./01 23456789:)<=>?@ABC DEFGHIJKLMNOPQRSTU VWXYZ[\]^**abcdef9 hijklmnopqpstuvwxy

EXPANDED 80 CHARACTER 5 FITCH

!"#\$%&!"#\$%&() ***,-../01
23456789:;<=>?@ABC
DEFGHIJKLMNOPQRSTU
VWXYZ[\]***abcdef9
hijklmnopgrstuvwxy

NORMAL 96 CHARACTER 12 FITCH

!"#\$%&^()*+,~./O1 23456789:;<=>?@ABC DEFGHIJKLMNOPQRSTU VWXYZI\]^+°abcdef9 hijklmnopqrstuvwxy EXPANDED 96 CHARACTER 6 PITCH

!"#\$%%'()*+,-./01 23456789;;<=>?@ABC DEFGHIJKLMNOPQRSTU VWXYZ[\]^+°abcdef9 hijklmnopqrstuvwxy

NORMAL 132 CHARACTER 16.5 PITCH

!"#\$Z&'()*+;-./01 23456789;;<=>?@ABC DEFGHIJKLMNOPQRSTU WXYZ[\]+*"abcdef9 hijklmnopqrstuvwxy

EXPANDED 132 CHARACTER 8.25 FITCH

!"#\$%&'()*+,-_,/01 23456789:;<=>?@ABC DEFGHIJKLMNOPQRSTU VWXYZ[\]+<"abcdefg hijklmnopgrstuvwxy

DIP Print Samples

Electronically the DIP-81 is just as simple. All components except the power transformer, bridge rectifier and cooling fan are mounted on a single P.C. board. Overseeing operation is an 8035 microprocessor with the control program in a pair of 2708 EPROMs. An 8155 RAM-I/O controiler round out the large scale ICs. Toss in a half dozen TTL parts, some voltage regulators and the TIP122 hammer drivers and you have a simple but efficient design. A quick note about the TIP122s: They were chosen because of their ability to drive inductive loads without the need for clamping diodes to suppress the inductive kickback of the print hammers, a sign of good design practice.

A parallel Centronics interface is standard with the unit though a serial RS-232 interface is available on the P.C. board as an option. Interestingly enough, simple conversion instructions are included in the operation and maintenance manual, but conversion by a non-authorized person voids the 90-day warranty.

There are three operator controls and two indicators on the front panel plus the on/off switch on the back panel. From left to right the controls are TOF (top of form), SEL/DESEL (select/deselect) and Line Feed. Since the DIP-81 doesn't have a sep-

arate paper feed motor, pressing TOF initiates a series of line feeds. At power-on, the printer assumes the paper is already at top of form. It then counts lines and if a TOF command is encountered, it advances to the next logical top of form and resets the line count. Line Feed initiates a single print cycle during which nothing is printed, although the print head travels across the paper. Again this is a result of using a single motor for all mechanical functions. It also explains why the DIP-81 is a bi-directional printer. You never know



on which side of the printer the print head will start or stop. Having a synchronous motor instead of a more position-precise stepper motor also causes a slight column misalignment during printing. SEL/DESEL determines if the printer is ready or not, if it is, the red select indicator directly above the SEL/DESEL switch will be on. In the deselected mode you can use the DIP-81's self-test feature. Pressing Line Feed and TOF simultaneously causes the printer to display the 96 ASCII characters it is capable of printing. The final Indicator is power-on located directly above Line Feed.

I ordered my DIP-81 with the parallel interface and connecting it to my LNW Expansion Interface was no problem. I did cut line 33, printer chassis ground, to avoid its being connected to signal ground in the expansion interface. The unit powered up and operated properly the first time I tried it. The DIP-81 lists for \$499 but, like all current printers, is being discounted. I got mine for \$395 and have seen it advertised since at \$379. In retrospect I am quite satisfied with my DIP-81. While I wouldn't recommend it for highest quality business applications, I do feel it makes an excellent printer for the personal computer owner.

Home Computer Work Table Computer Roomers, Inc. Delles, TX \$179.95

by Dan Keen and Deve Dischert

hen microcomputing was "just a hobby", we were content to stick the computer in a back room of the house. But then we became computer-holics, never leaving the machine except to eat, and go to work. So, we centrally located our TRS-80 in the living room.

Now we needed to solve the problem of what to set it on. We have a Daisy Wheel II which develops a lot of torque and requires a table of steady support, preferably one made out of cast Iron or concrete. Daisy is also very wide, which makes placement difficult in some areas of the room.

Since the unit was to be placed in a very visible part of the house, it needed to be decorative.

So the criteria for our table was that it had to be firm, well built, be able to provide a home for peripherals, and provide a work space. It had to look nice and most of all, since we are cheapskates, it had to be reasonably priced.

This describes a new computer table from Computer Roomers, Inc. which has a nice walnut wood grain look with black trim.

The unit came in a box and though it was only about three inches deep, it was wide and heavy! (Plan on inviting a friend over the day you expect delivery.) It was packed extremely well, using big pieces of custom cut styrofoam.

We found that the shelf which is at the rear of the table and runs along its entire width is the exact depth of our Shack disk drive as well as a friend's Apple drive, and we would assume most 5-inch disk drives. This shelf (called a video shelf) is a real plus since it gives you more room on which to place items and yet doesn't take up any more space in the room. The video monitor fits well on the shelf also, along

"We...enjoy our new table." with four drives and cassette recorder (your monitor can't sit on that interface any longer). Personally, we found this preferable to desks which have a shelf underneath to house only the drives. Frequently we have more than one person sitting at the console, and this table has plenty of leg room.

An open space along the rear allows for cables and wires to be routed neatly out the back.

It's so easy to put together "even a child can do it" ... well almost. It took about 20 minutes to essemble. They say "no tools needed," but we did need a hammer to tap a few sectors into their locked position. A wide blade screwdriver is required for disassembly.

While the instruction manual pictures the desk with two "wing" extension shelves, it is apparent that only one at a time can be used. We assembled two tables, and both were missing the necessary "shoulder screws" that mount the second side. So, although a left and right wing come with the unit, plan on only using one or the other.

We thoroughly enjoy our new table, but some computerists may find its lack of drawers a slight disadvantage. ■



UCSD Pascel Compiler FMG Corporetion Fort Worth, TX \$250

by Dennis Thurlow

Irst, will all of you who program 370's for a living, and are only reading this to find out about "little" computers, please wait on the other side of the room?

Now, I did that because those guys would laugh it I called Basic a language because, in fact, it isn't! Basic is a code that must be interpreted by a large machine-language program called (appropriately enough) an interpreter. Usually an editor of some kind is included to help you build the code, make changes if necessary, and save the code to a storage medium.

A real language, on the other hand, is used by a compiler to generate machine code that is directly saved to disk or tape, or automatically executed. Since the system was never meant to be interactive, no editor is included and the program is usually punched onto cards and fed into the computer.

Let me also point out that there are exceptions to the rule. There are Basics that compile, and versions of languages, such as Cobol, that run on interpreters. And then there is Pascal.

The Lenguage

Pascal incorporates all the standard programming features found in most languages, but the syntax is much easier to learn. Example 1 presents a typical Pascal program and Exemple 2 is the same program in a non-structured format. Both run identically, compile to the same number of bytes, and follow the same syntax rules, as laid out in the syntax tables in Examples 3–5.

Example 3 Indicates that a program must start with the word Program. Any time a word or character appears in a balloon (rounded corners) it must be entered literally. You can see that the word Pro-

PROGRAM TEST (OUTPUT);

BEGIN

VAR

X:INTEGER;

REPEAT

WRITE(X, SQUARED = ', SQR(X));

WRITELN(THE SQUARE ROOT OF ', X,', SORT(X));

UNTIL X>100;

WRITELN('DONE')

END

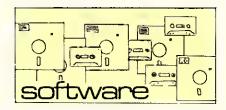
Example 1.

gram is in both Examples 1 and 2.

Next an Identifier is required. The square corners indicate that options are available and that there is probably another syntax table to define those options. In this case Example 3a is the syntax table for identifiers. In Example 1 the Identifier is the word Test.

The identifier in parentheses usually defines whether I/O is going to be used. Note that all statements in Pascal end with a semicolon. The program itself ends with a period.

Example 4 is the syntax table for a block. It provides for variable definitions and the procedures used in Examples 1 and 2. To define a statement you must use the syntax table in Example 5. You can

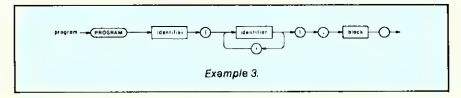


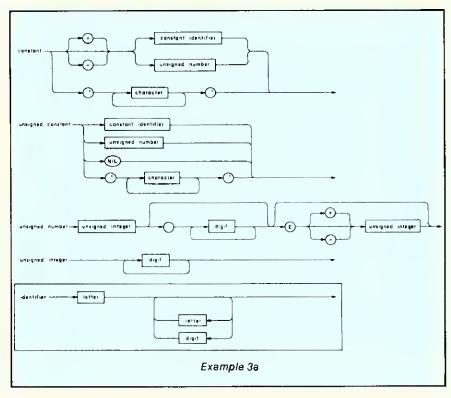
elso define procedures and functions that will be used repeatedly.

Structuring is important when you develop large programs that someone else may have to maintain, or that take so long to write you forget what was going on in the different sections. Professional programmers, in particular, tend to favor structured programming, particularly

PROGRAM TEST (OUTPUT); BEGIN VAR X: INTEGER; REPEAT WRITE(X, SQUARED = ', SQR(X)); WRITELN('THE SQUARE ROOT OF ', X, 'IS', SQRT(X)); UNTIL X>100; WRITELN('DONE') END.

Example 2.





when it is this easy!

The FMG package is on three disks. The modules are arranged to allow for maximum free space on the disk, which is usually about 30K. Interaction with the user is achieved with a command prompt line upon boot up. From this the user can call up:

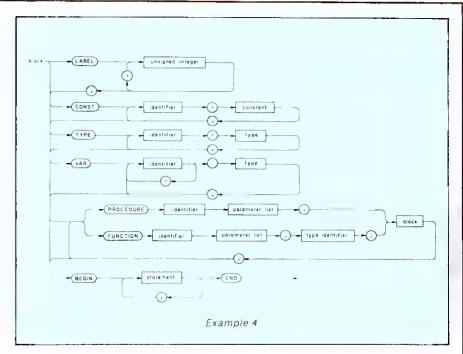
- 1. L(ink): The linker grafts routines from the System Library to the program that is to be compiled. You may also link to machine-language routines that you have written yourself! The advantage of this is that only those routines that are necessary to run the program are linked. This results in a tremendous saving of space and time.
- 2. C(omp): The compiler saves the compiled program to disk.
- 3. X(ecute): Execute a program that is already linked and compiled.
- 4. R(un): Compiles a program that has been linked, and runs it instead of saving it.
- 5. F(ile): The filer handles all the disk I/O that a DOS would take care of in othe interactive systems. This is one of th two routines added by UCSD to make Pascal interactive.
- 6. E(dit): This editor is specifically for constructing Pascal code. By inserting a different disk you could call the editor for the assembler, also supplied. The keyboard is debounced, but is a little slow.

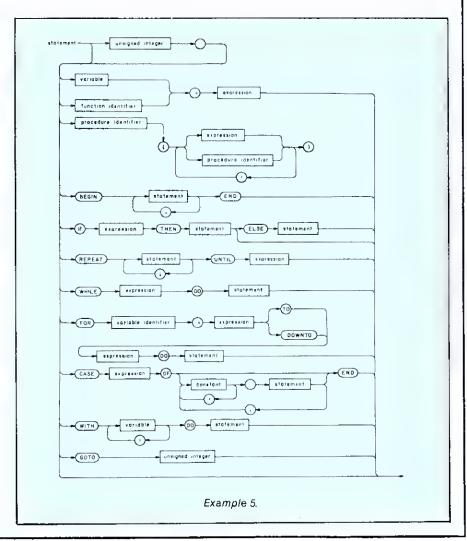
All the modules work very well, and generate nice, compact code, compared to Microsoft's Basic compiler, for instance. The program in Example 1 takes 1407 bytes of code when compiled and linked. This may appear to be quite a bit when compared to the 198 bytes of Pascal code, but remember that most the overhead is constant, and as your programs get longer, the overhead gets less significant. And it's still quite a savings over the 14K the same program takes compiled with Microsoft's Besic compiler.

The Documentation

The sore point of the package is the documentation. The manual is a 284-page looseleaf folder. It was written to supplement a teacher's instruction, and does not teach you Pascal. You must know Pascal or be learning it from another text (or teacher) to use this compiler.

Another problem is that the manual is the same one used with the PDP-11 and CP/M versions of the package. Most of the examples and tables are useless unless you keep flipping back to the additions in the front of the book. And, lest you get your hopes up, let me say that there are only seven of those pages.





THE ASSEMBLY LINE

by William Barden, Jr.

"Look on these next two columns as a sort of "Cliff Notes" about the book—a supplement to those six pages."

'm currently reading Going Ahead With Extended Color Basic. I was even amused by the drawings of the Color Computer with legs, the result of inbreeding in the Radio Sheck computer line. Everything was fine until I got to page 144. Even though it was an exciting plot, the next six pages took several days to get through. Look upon these next two columns, then, as a sort of "Cliff Notes" about the book—one that you can read to supplement those six pages.

These columns are meant to give Color Computer essembly lenguage users some hope. Model I and III users may wish to read them to see how the 6809 compares to the Z80.

First let me say that the Extended Col-

or Besic book is very well written— Jonathen Ericson at Radio Shack deserves credit. The book is geared to the first time user, end it's very difficult to present detailed mechine language information in six pages.

We'll start from the ground up, so the first-time Basic programmer may be able to get into machine language programming with a minimum of griaf. Experienced programmers, bear with me for a while.

6809 Machine Language

The Color Computer uses the 6809 microprocessor which is an upgrede of the popular 6800. Both microprocessors are manufactured by Motorola. The 6809

instructions include the 6800 instructions as a subset on an assembly language level.

This means that both instruction sets would have similar instruction mnemonics, such as CLRA, for Clear A, but that the binary value for instructions might be different between the two. One important implication of this is that you can't pick up the *machine code* for a 6800 program and run it on the Coior Computer—It probably won't work. You might be able to pick up the assembly-language code for a 6800 program, however, feed it into the Coior Computer assembler, and get resulting object code that works.

A sample of 6809 machine language is shown in Fig. 1. This happens to be a short segment of code that will divide the contents of a 16-bit value by two. The code is in hexadecimal, which is a shorthand way of representing binary data. One hexadecimal digit represents four binary digits, or bits. Two hexadecimal digits represents two groups of four binary digits.

The basic number of bits in the Color Computer and 6809 is eight, constituting one byte. All memory and CPU operations generally transfer data and perform operations on eight bits or one byte of data. Eight bits can hold binary values of 00000000 through 111111111, the decimal value of 0 through 255, or the hexadecimal value of \$00 through \$FF. The prefix \$ is used in the 6809 and other microprocessors to indicate that the following data is in hexadecimal. Basic uses &H in lieu of the \$.

If you're hezy about binery end hexedecimal, you'll have e tough time following enything from this point. Proceed as follows: Go to a chapter on binary and hexadecimal in any basic computer text end practice some conversions between binery, decimal, end hexadecimal. You don't have to spend hours in practice, but get a nodding familiarity.

Back to the machine language . . . A machine language instruction consists of one, two, three, or four bytes of data that the 6809 will recognize as an instruction. The instructions will range from

		One H	exadecimal Digit C	or four Bits		
		8D, 63, ED,				
		44,				
Nine Bytes		56,				
Of Machine		BD, B4, F4,				
Code		39 Two	Hex Olgita, 8 Olt	s, Or One Byt	e	
	HEX	SINARY	DECIMAL	HEX	SINARY	DECIMAL
	0	0000	0	8	1000	8
	1	0001	1	9	1001	9
	2	0010	2	Α	1010	10
	3	0011	3	е	1011	11
	4	0100	4	С	1100	12
	5	0101	5	D	1101	13
	6	0110	6	E	1110	14
	7	0111	7	F	1111	15

Machine Code		Assembly-Language	Code	
	LABEL COLUMN	OP-CODE COLUMN	OPERAND COLUMN	COMMENTS COLUMN
6D,63,ED 44, 56,	START	JSR LSRA RORE	\$B3ED	FIND INTEGER SHIFT A ROTATE B
ED,64,F4,		JSR RTS	\$84F4	FIND FLOATING RETURN

such simple operations as putting a zero into a CPU register, on up to a multiply. The instructions from Fig. 1 are shown in Fig. 2 with the operations they represent.

Assembly Lenguege for the 6809

Fig. 2 shows the machine-language codes on the left, and the equivalent assembly on the right. The *mnemonics* are just what they sound like (from Mnemosyne, the Greek goddess of computer writers)—abbreviations for 6809 instructions. For example, it's much easier to write LDX instead of Load the X Register.

The mnemonics for the instructions are called *op* codes, short for operation codes and are in the second column of the assembly language. The third column figure is the operand column. Certain Instructions require no operands, while others require several operands. To transfer data from a memory location to the X register, for example, an LDX \$2000 would have the mnemonic LDX and an operand of \$2000.

The first column of the assembly language represents a label field. The location of an instruction might be labeled with a label such as LOOP and subsequent instructions could refer to the location by the label, rather than an absolute address, such as BEQ LOOP, which would be a "Branch on Equal to location LOOP."

The last column holds applicable comments.

The portion of the figure representing the labels, op codes, operands, and comments field in Fig. 2 is the assembly language. The portion on the left with the hexadecimal values is the machine language. The assembly language code, called the source code is translated into the proper machine language by an assembler program for the Color Computer. (By the time you read this, the Radio Shack Color Computer assembler should be out.) The assembler decodes the symbols into the proper machine language instructions.

Not only is it possible to translate from assembly language into machine language, but It's possible to go the other way, from machine language into assembly language. A disassembler program will examine a machine language program and produce the mnemonics and operands. There are several disassemblers available currently for the Color Computer.

Hend Assembling

In the remainder of this discussion we'll be using examples of machine

ianguage rather than assembly lenguage. It is possible to bypass an assembly process by doing hand conversion of what looks like essembly language code. An example is shown in Fig. 3. The instructions are first written down with their op codes and operands. Next, each instruction is "roughed out" as far as the number of bytes in the instruction. Next, the op code values are filled in, followed by the values for the operands.

This process is not a simple one. It requires a good book on the 6809 instruction sat, and some study about the CPU registers, instructions, and addressing modes. The bible for this instruction is not Barden, or Leventhal, or Warren, but Motorola. Motorola's MC6809 Preliminary Programming Menual is evailable from Motorola Semiconductor Products Inc., 3501 Ed Bluestein Blvd., Austin, TX 78721.

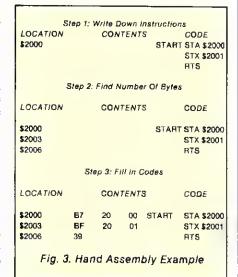
Next let's make certain we know something about the Internal erchitecture of the 6809. The 6809 chip has a number of registers. A register is nothing more than an eight or 16-bit memory location that is located in the CPU, rather than in RAM memory.

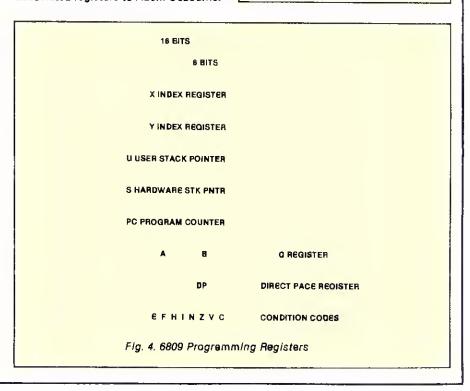
The registers are assigned names that are related to their function. Flg. 4 shows the 6809 registers that are accessible to the programmer. There are other registers, of course, but we'll leave an excruciatingly detailed account of the internal operation of the memory fetch cycle and the associated registers to Adam Osbourne.

6809 Regletere

The A and B registers are eight-bit registers that hold the results of arithmetical, logical, and other types of operations. They are called accumulators, and are used to process data by adds, subtracts, shifts, exclusive ORs, and so forth. A and B can be lumped together to form one 16-bit register called the D register to allow operations on 18 bits at a time.

The PC is the Program Counter register. It points to the next instruction byte. For a machine language instruction







THE ASSEMBLY LINE

of three bytes, the PC will increment three times as the three machine language bytes are assembled in the CPU. This is the fetch cycle. At the end of the fetch cycle, the PC points to the next memory location, which must hold another instruction.

At the end of the fetch cycle, the assembled instruction is executed. This might involve reading an eight or 16-bit operand from memory and adding it to the A register, loading the B register with the contents of the A register, or many other operations. The fetch and execute cycles are executed automatically with each instruction-for the time being, simply forget about the two separate parts of an instruction. About the only consideration is that more involved instructions take longer to execute; this is sometimes a factor when you're figuring out timing loops or trying to speed up programs.

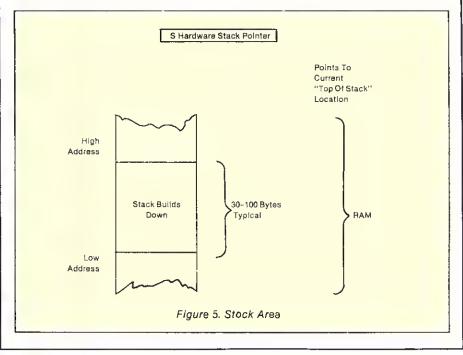
The S, or Hardware Stack Pointer, points to the stack area of memory. Stack can be located just about anywhere the programmer desires (ROM is a bad choice). Usually 100 bytes of stack is sufficient. The stack (see Fig. 5) is an area used to store return addresses for subroutine calls, temporary data from the CPU registers, or interrupt addresses. Branching to a subroutine saves the return address on the stack, for example, and a subsequent RTS, or Return from Subroutine, instruction retrieves the return address from the stack. The stack builds down from high memory to low memory as addresses or data is pushed onto it.

The U register, or User Stack, Is a second stack pointer that points to a user-specified stack. The S register is a hardware stack, since it is related to the built-in hardware functions that store data in the area pointed to by S, such as "branching to subroutines." The U stack area may be redefined constantly for the programmer's convenience.

The X and Y registers are *index registers*. They are used to point to the location of memory operands. Operands beyond or prior to the pointer may then be easily accessed by an indexed-type instruction, such as "LDX + 20,X", which loads the contents of a location pointed to by the index register *plus* 20 locations. The X and Y registers are continually loaded with new values as new blocks of data are accessed.

The DP, or Direct Page register, is used to define pages of 256 bytes. This is an optional addressing mode that allows shorter instructions (using less memory and time). We won't be using this mode in the examples here.

The Condition Code register is an eight-bit register that is really a conglomeration of eight bits. These condition codes are set (1) or reset (0) according to the actions of certain instructions. The Z condition code, for example, is set if the result of an add (and many other instructions) is a zero. The condition codes may be tested by conditional jumps and branches that follow the operations. This is the main way of altering the path of a program. A "BEQ \$2000", for example, branches to an instruction at location 2000 hex if the result of the last operation



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THE ASSEMBLY LINE

was zero; if the result was not zero, the next instruction after the BEQ is executed.

On to the Six Pages

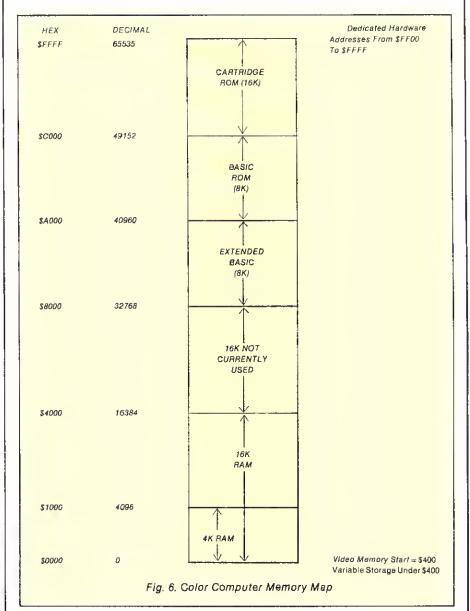
Well, we're finally there: The first machine language related Basic command to consider is Clear. The format of Clear Is: CLEAR XX, YYYYY.

The XX represents the decimal number of bytes to reserve for string storage. The YYYYY represents the area of memory to be reserved for machine language programs. Typically, a "Clear 100,YYYYY" would be fine, unless your program has a lot of string storage. The YYYYY is a number that protects RAM beyond a certain point. For our purposes we'll use a YYYYY of \$2000, which is 8191 decimal. This will prevent Basic from using anything above memory location 8191 for stack or string storage. This leaves about 379 bytes of memory for Basic programs and variables, which is somewhat on the sparse side but enough for our purposes.

A memory map for the Color Computer is shown in Fig. 6. Note that Color Basic is above the Extended Color Basic, that video memory starts at \$400, and that page 0, 1, 2, and 3 is used for variable storage. Also interesting is the fact that the Color Computer uses high-memory addresses to address various functions for graphics functions, sound generation, serial data, and the like.

Stack Area

We won't explicitly set the S register to



THE ASSEMBLY LINE

a stack erea in the following examples. It is set in Basic, and points to a 30-byte stack area. Unless you're doing a lot of processing, it's not necessary to redefine it by a load of the stack pointer in your program.

The DEFUSRn Commend

The next machine language related Basic command we'll tackle is DEFUSRn. DEFUSRn is unsophisticated; it simply tells the Basic interpreter where a user mechine language subroutine will be located. The n may be any decimal value from zero through nine, allowing for 10 unique machine language subroutines.

Suppose we had a machine language subroutine for division at location \$2000 (8192 decimal) and another to find the integer solutions to $A^N + B^N = C^N$ (see Fermat's last theorem) at location \$2100 (8448 decimal). We could define the lo-

"I was amused by the Color Computer with legs, a result of inbreeding..."

cations by: 100 DEFUSR0 = &H2000: DEFUSR1 = &H2100.

From that point on in the Basic program, the ID number of zero would be associated with the divide routine and the ID number of one with the Fermat processing. The ID numbers would be used in conjunction with a USRn call to call the subroutines as required from the Basic program. For example, 1300 A = USR1 (0) would call the Fermat processing routine. The machine code would be entered by USR1 in statement 1300, and, after processing was done, a return would be automatically made to the Besic statement following line 1300.

This is probably a good point to determine what type of machine language subroutines should be called; any type. Whatever proves useful from a Basic program—subroutines that are often called and that can do things faster than the equivalent Basic code, such as sorts of strings, serial I/O, or number crunching. Furthermore, the subroutines may be any size, from two or three instructions, up to thousands. In addition, the subroutines may even be ROM subroutines

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in Basic ROM that are convenient. One example of this is the cassette subroutines in ROM that allow the user to construct his own cassette tape files. Larger programs that operate only in machine language can be loaded and exacuted by the CLOADM command, followed by EXEC. We'll give these only a passing mention in this article, as they are usually large dedicated assembly language programs.

The Simplest USR Cell

We're finally at a "real" USR call. The Basic code shown in Program Listing 1 defines the simplest call to a machine language subroutine. The subroutine in this case consists of a single instruction, an RTS, or "Return From Subroutine," shown in Fig. 7. The RTS must terminate every machine language subroutine. It POPs the return address of the Basic USR processing code from the hardware stack and causes a return to Basic. All we've really done here is define a machine language subroutine at \$A936 and call it by the USRO. The subroutine is repeatedly cailed by a GOTO 200.

The call was made with two dummy arguments, zero and A. The argument of

100 OFFUSR0 = &HA936

200 A = USR0(0) 300 l=1+1

400 PRINT I

500 GOTO 200

Program Listing 1. Simplest USRn Call.

100 OEFUSR0 = &HA928

200 A = USR0(0)

300 GOTO 200

Program Listing 2. Calling a ROM Subroutine

05FF CMPX #1535 A931 8C eus \$A92F A934 23 F9 RTS A936 39

> Single RTS Instruction At Location \$A936

Fig. 7. Simplest Subroutine

zero within the parentheses is the input argument. A pointer to its location is passed to the subroutine. The argument of A is the output argument. A possible value from the subroutine is returned in variable A. Both these arguments are dummies in this case, as the subroutine does not require an operand to be passed to it; neither does it return an operand. Use zero for the input and any variable for the output argument as dummies; if you don't, you'll get a nasty message from the Basic interpreter.

Muitiple USRn Cells

Next, we'll tackle two USRn calls. Program Listing 2 is a Basic program that defines two machine language subroutines, one at \$A936 and another at \$A7D7. Both are one-instruction subroutines consisting of RTS instructions in ROM. Here again, the locations are defined, and repetitive calls are made to each subroutine.

A ROM Subroutine Cell

Program Listing 3 shows a call to a ROM subroutine at location \$A928. From a disassembly, I found that this code clears the screen. The call with two dummy arguments repetitively executes the machine language code to clear the screen.

Peesing Arguments to the Subroutine

Those of you making snide noises about simple writers, you're about to get your comeuppance . . .

Let's look at how an argument is passed to a machine language subroutine. Two sentences in the Extended Color manual have implications that Adam Osbourne couldn't explain even

	Hex	Decimal
Code	Machine Code	Machine Code
STA \$2000	B7 2000	183,32,0,
STX \$2001	BF 2001	191,32,1,
RTS	39	57

Fig. 8. Store A/X Program

100	DEFUSR0 = &HA936
150	DEFUSR1 = &HA7D7
200	A = USR0(0)
250	A = USR1(0)
	I=I+1
400	PRINT I
500	GOTO 200
Program L Calls	Isting 3. Multiple USAn

THE ASSEMBLY LINE

with timing charts . . .

According to the manual, the USRn call results in the A register being loaded with a code for the type of argument and the X register being loaded with a pointer to something called a "floating-point accumulator." What does this mean? How did we suddenly go from no arguments to floating point?

To see what is happening, we'll use our first hand-assembled program, shown in Flg. 8. This three-instruction program stores the contents of the A register into location \$2000 and the contents of the X register into locations \$2001 and \$2002. The last instruction is the ubiquitous RTS. We can use this gem to see how A and X look upon entry to the machine language program. The Basic program in Program Listing 4 shows the approach.

The values for the three Instructions are first converted to decimal, a total of seven bytes. The code will occupy RAM locations \$2003 through \$2009. The Basic statements use a data list of the velues, a Read and a POKE to move the values from the data list to RAM. Next, e call is made by USRO(0). This call executes the three Instructions, which store A and X. The last three Basic statements print location \$2000 (A), and locations \$2001 and \$2002 (X).

When this program is run, we see a display of 0, 0, and 79, indicating that the A register held 0 on entry and that X held 0,79, or 79. (The first value for X is the upper eight bits, while the second is the lower eight bits; together they constitute the entire 16 bits of X.)

The 0 in A indicates a numeric argument, according to the Extended Basic manual. The 79 is a "pointer to the Floating-Point Accumulator which contains the argument." What's in location 79 and what is its format?

We'll answer these questions and more when we continue with the "Saga of the Six Pages" in next month's column. Stay tuned to 80 Micro. ■

- 100 DATA 183,32,0,191,32,1,57
- 105 DEFUSR0 = &H2003
- 110 FOR I = & H2003 TO & H2009
- 120 READ A
- 130 POKE I.A
- 140 NEXT I
- 150 A = USR(0)
- 160 FOR I = &H2000 TO &H2002
- 170 PRINT PEEK(I)
- 180 NEXT I

Program Listing 4. Basic Program to Analyze A/X

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EDUCATION 80

"Most of us have wasted a lot of time reloading programs because we did not follow instructions."

ow many times have your students loaded programs and had them crash because they forgot to set the memory size? How many times have you done it? I suspect that most of us have wasted a lot of time reloading programs because we did not follow instructions carefully.

All these crashes and reloads are unnecessary. The program itself can set the memory size as soon as it is run. Unfortunately, many programmers have not learned how it is done.

If you are not putting this feature in your programs, these directions will show you how to do so. You can even go back and add "auto mem set" to your old programs and to the programs of others, as well.

Auto Mem Set

This technique works in Level II and in Model III Basic. I have also used it in two versions of TRSDOS and suspect that it will work in all versions. If you use another DOS, try it carefully before you change all your programs just in case your DOS modifies the memory locations used.

Memory locations 16561 and 16562 contain the numbers which protect memory; that is, they set the memory size. All the program has to do is POKE the proper numbers into those places. Location 16561 holds the low-order byte and 16562, the high-order byte. Let's run through a specific example.

Suppose your program requires that memory size be set at 32699. You would go through the following steps:

 Subtract two from the required size and call the result X.

> 32899 - 2 = 32697 X = 32697

Divide X by 256 and discard any remainder (use only the whole number part of the answer). This is the highorder byte.

> 32697 / 256 = 127.723 High Order Byte = 127

Multiply the high order byte by 256 and subtract the result from X. This is the low-order byte.

 $32697 - (127 \times 258) = 185$ Low Order Byte = 185

 Insert the following statement at the beginning of your program:

3 POKE 16561, 185 : POKE 16562, 127

By following these steps, the memory size is set at 32699 just as though you had answered the prompt message with that number. Of course, the memory is not set until the program is run.

Did you notice the low line number in step four? It was made low for a reason. The memory size should be set at the beginning of the program—before any other statements are executed (except for remarks). If you set (or change) the memory size after the program is under way, the memory effocation will be wrong for program operation. What happens is

"You might jump into areas the program has set aside..."

that you might jump into areas that the program has set aside for the stacks or variable storage or something else. This would cause the program to crash.

So, set the memory size first. The line number above 3 will remind you to do that. I would have numbered it "1" but most of us use the first line or two for remarks which identify the program.

Before you change your programs over, this technique may save you some time, too. Suppose you (or a student) begin loading a program and suddenly realize that the memory should have been set. All you have to do is to figure the high and low bytes as above and then execute the statement in step four in the immediate mode before the program is run. The size will be set just as though the statement were in the program.

Chein-Loading Programs

At this time of the year both students and faculty are settled down from the in-Itial flurry of getting school started. This is the time, too, when it dawns on other students and faculty that it might be prudent to learn something about your computer operation.

Often their first question is, "What is the thing good for?" You should have a special program sampler prepared just for such occasions. Sampler—that's what I call a program that consists of several demonstration programs. Here is how you can make one.

The idea is to select a few programs which show off your computer. This might include games, graphic displays or instructional programs.

Next, write a Menu Program which will fill two functions: it allows the operator to choose among the programs you selected, and then it automatically calls up the selected program.

Finally, put all the programs on the tape or disk with the Menu Program and you are ready to go. Let's look at the make-up of that first program.

The Menu Program

The Menu Program is straightforward. It presents a list of the available programs and allows the operator to select one by entering the corresponding number. There are several ways to get the selected program into the computer but I will show you the simplest method. If you use the standard cassette, it would go something like this:

...list and selection...
....number selected is in variable A....
250 ON A GOTO 260, 270, 280, 290, 300, etc
260 CLOAD "A"
270 CLOAD "B"
280 CLOAD "C"
290 ...etc...

It is evident that programs A, B, C and so on must be properly labeled when saved and they must follow the Menu Program on the tape. Then, too, the tape must be rewound after each selected program has been loaded.

If you are using the Exatron Stringy-Floppy, the appropriate statement would be: 250 @LOAD A + 1. The advantage to the ESF is its fast load time and the fact that it does not have to be rewound. However, you should provide enough space to hold the longest program (see the manual for details).

If you are using Disk Basic, your statements would look like this:

250 ON A GOTO 260, 270, 280,..... 260 RUN "STORYBOOK" 270 RUN "MATH I" 280

Of course, both the cessette and disk systems offer neater ways to accomplish this programming, but these are the easlest to understand. You might experiment to discover shorter methods with your system.

I have put together several disks which follow this plan—one for science, one for math, one for language arts, and so on. Since making them, life has been easier. I simply put in the appropriate disk and say, "Try it for yourself."

Reader Inquiry

Bjarne Madsen in Saksatchewan, Canada, leads a project which developed a curriculum for computer ewereness and programming techniques at the junior high school level. His course has proved very successful in classroom tests

BJ is quite interested in corresponding with others who may be involved in a similar effort. The exchange of ideas could be beneficial to both parties. If you have worked in this area, send me your name and I'll pass it along to BJ.

In fact, if you are interested in communicating with others in any area of interest, send me your name, complete address, and the areas of interest. Include a statement to the effect that you would like that information published and, as space permits, I'll put it in Education 80 so that others can get in touch with you.

New Address

This summer I took time out to move across the state. For six weeks or so I was out of touch with everything except boxes to pack and unpack. I don't know if I'll ever catch up with what happened in the world of computers. (I have caught up with the new Model III TRSDOS 1.3 which offers significant improvements on an already good 1.2 version.)

However, I am happy to report that my computers made the trip in fine shape—not even a slight hiccup when I finally got settled enough to hook all the pieces together and plug them in. So much for my fears of horrendous repair bills!

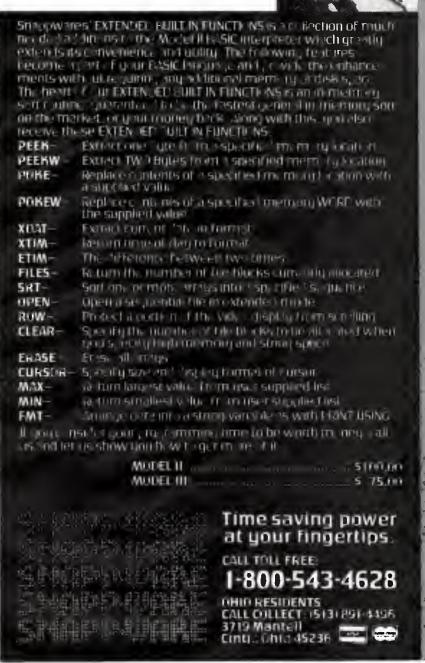
My new address is 6 Darl Avenue, Coloniel Beach, VA 22443. Of course, you may write me through 80 Microcomputing. Either way, please enclose a self-addressed, stamped envelope and l'il get back to you when time permits.

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80 APPLICATIONS by Dennis Kitsz

Way back in the aerly days of 80 Microcomputing, I created a machinelanguage monitor called Babybug. It was short, written in Besic, and sparked with a large and continuing reader response. Since that time, many excellent programs for examining and modifying TRS-80 mamory have appeared, and some interesting software is beginning to be offered for the Model III and the Color Computer as well.

This month I'd like to prasent new varsions of tha original Babybug: a condansed and improved Modal I or III program, plus versions for Color Basic and Extended Color Basic. Once again, they are writtan antiraly in Basic, yet consuma small amounts of mamory. Befora turning to the programs, I'd like to explain what a machina languaga monitor is, how it is used, talk about entry and display in hexadecimal numbering, and in passing describe tha process of packing information into integers.

A Window into Mamory

At soma point in tha lifa of evary programmar—amataur or profassional—comas the desira to hava programs parform faster or usa lass memory. There also comes craaping the naad to understand what makes the computer tick, why protacted mamory is sometimas necessary, and maybe just what kind of software is hiddan insida that anonymous box. It's that Something which gives the system life, makes it say "OK" when it understands you and "?SN ERROR" when it doesn't.

Small computers are meda up of savarel classea of black boxes which compose a computar whan connected togather. In its purest form, the computer wa know consists of a ganaral-purpose, simple-minded calculator—the cantral processing unit (CPU). The CPU is connected to one or more blocks of temporary or fixed storaga/instruction area, its mamory. Finally, communication with the real world is achieved with input/out-put (I/O) devices.

The Babybug machina-languaga monitor is concarned with the contents of read/write memory—that is, memory which may be examined or changed by the CPU. It can also be used to examine

parmanent (read-only) memory, in order to see what the CPU follows to parform its work in Basic. With a monitor, I can ask the computer to tell me what is found at its mamory location 0 or 100 or 24576 or 65500. In tha Model I, if I examina location 0 I will find tha valua 243; if I examina location 100, chances are tha valua 251 will turn up. Both 0 and 100 are in parmanant, raed-only memory (ROM). On the other hand, locations 0 and 100 ara in temporary mamory in the Color Computar, holding the values 0 and 171 when Basic is in operation. Modal I locations 24576 or 65500 may ravael enything, sinca they are read/write memory (also called random-access memory, or RAM)-whatever tha computer last placed there. In the Color Computer, 24576 is read-only mamory, and 65500 is part of I/O mamory. With the Babybug machina-language monitor, I can read memory and change its contents at will.

What is the machine language that Babybug monitors? Sinca the information stored in any spot in memory can be thought of as instructions intended for tha CPU's intarnal mechanism, causing it to raspond according to a predaterminad pattarn, auch mamory contents are called machine language, or machine coda. Throughout this magazine, you will find listings writtan in Basic, but other software is prasanted in rigorous-looking listings for the Editor/Assamblar. This is assembly language, maraly a convenient form of producing numerical machine instructions using English-sounding names instaad of numbers alona.

Tha basics of machine and assambly programming have been presented in this column before (see aspecially March 1981), in Bill Bardan's monthly Assambly Line column, as well as in many other fine articles. These fundamentals won't be repeated here, but I would like to explain why so often you will find machine code used in this column, and why non-decimal notation can be very ravaeling when programming et the machine level—as well as in sophisticated Basic.

Computers are nothing more than an erray of fast on-off toggle switches, which means if you learn to read the toggle switches, you know exactly what your

computar is doing. For axample, in May I presented a Micro Front Penel construction project. It's a bank of 24 LEDs which flash a binary value according to the current memory location the computer is using. It displays both the location (address) and the information (data). Several people have written to me asking what good it is, and I raply with an example: when programs seam to get lost, there's practically no way to know whether they are truly lost, maraly involved in some time-consuming process, or hung up in a minor program glitch.

Something peculiar happaned when I triad to load one disk. The familiar noisas took placa, but then averything just stopped. I prassad the raset button again, tha system reacted normally, but than just stopped. I glanced down at my Micro Front Panal, which read:

I		1		
1	LSB	MSB	DATA	-
ı	0000 0000	0100 0010	0000 0000	-

It told ma that my computar stopped writing data at binary addrass 0100 0010 0000 0000 (which translatas to hexadecimal address 4200) and tha data it wrota there was 00. I happen to know that 4200 is where the disk's bootstrap load routine is placad in mamory, so I learnad that the bootstrap loader was navar written.

With the front penel I can also observe that the machine is still working when it pauses during a long program and will not respond to the Break key. Those of you whose programs have been trapped in seemingly interminable string sorts (where garbage collection is in progress) can be reassured that there is activity even though the machine seems hung.

My point? Only that there is no way to know exactly where a machine is hung (and what to do about it) unless you can dacipher binary numbers.

If that's too esotaric a notion, try this simplar on a from tha raalm of Basic: By using a single intagar, you want to find out whathar a person on your mailing list (a) has one of up to aight spacial skills; (b) was originally contacted through one of aight possible methods; (c) responded to

one of eight mailings; (d) attended the last meeting; (e) was contacted by phone; (f) paid the most recent dues; (g) registered for an upcoming seminar; (h) participated in an event; and (i) turned in a survey form. Can you do it? In binary, it's possible.

Data Packing is Binary

Program Listing 1 is a possible solution to that question, drawn from a larger program. It requires an understanding of the binary consequences of some integer action in the computer, and also demands knowledge of the logical functions (AND, OR). Although this section of the program by itself seems lengthy, the resulting information is only one integer, meaning it can be stored in your mailing list or other data file as an economical single integer—just two bytes of memory or file space!

Here's a look at the byte the program starts with, represented by integer Q: 0000 0000 0000 0000. In the TRS-80, the lettmost binary digit (bit) is reserved for the number's sign. Zero defines a positive integer, one defines a negative integer. Since coded information containing a minus sign might look strange, I've discarded the lettmost bit in this scheme, leaving: (0)000 0000 0000 0000.

Defining the arrangement of information to be stored in the two-byte integer is arbitrary. In the sample listing, there are eight choices for the first input (lines 150 to 280 in Listing 1), so I reserved the leftmost three bits for the response. Why only three bits for eight choices? Because there are eight possible combinations of these three bits: 000, 001, 010, 011, 100, 101, 110, and 111. Likewise, the second input (lines 310 to 390) can allow eight possible choices, as can the third input (lines 420 to 550). The remaining questions are yes or no responses, meaning only a single bit need be used for each (1 = yes, 0 = no). The result is a positive integer with its bits divided as in Table 1.

Now, the bits themselves have to be made accessible to us, which means it's essential to know the value of each bit in the integer. Since this is binary numbering, these are simply powers of two. Simply, i said? Sure. In decimal, the numbers are ranked according to powers of 10, which in elementary school was referred to as the "one's place," the "ten's place," the "hundred's place," etc. In binary, the numbers are still called out by their places, except that they would be called the "one's place," "two's place," "four's place," "eight's place," and so on.

That breaks the binary integer up as shown in Table 2.



80 APPLICATIONS

Turn to line 300 in Listing 1, perticularly the command $A = (A-1) \times 4096$. Notice that the variable A was set to be the numerical result of the input from choices one through eight, in lines 170 to 240. Since the bit patterns to be used to represent these choices run from 000 to 111 (decimal 0 to 7), the value of A must be decreased by one to force it to be within the range 0 to 7. That's the easy part.

The upper three bits of the integer are

going to be used to store variable A; those upper three bits are the 16384's place, the 8192's place, and the 4096's place. Table 3 is a chart of the possible combinations.

With this in mInd, you can see how line 300 creates the upper part of the integer out of this pattern of eight choices by multiplying by 4096. The final command in the line Is Q = Q OR A. Again, this is visualized in binary, since logical functions AND, OR, and NOT operate on

binary digits. Here's what happens, assuming choice 8 was selected:

```
O at start = 000 0000 0000 0000
A is selected = 111 0000 0000 0000
O OR A function
Result = 111 0000 0000 0000
```

...........

Remember that the OR function specifies that if either bit X or bit Y (or both) is 1, then the result will be 1. The reason for using the OR function here is to leave the original bits untouched while setting (changing to 1) the bits that are needed to produce a packed byte. Turn to line 410 to see how another group of bits is packed into integer Q. Again, the first part of the command $A = (A-1) \times 512$ moves veriable A from its original input range of 1 to 8 down to the range of 0 to 7, because three bits are being reserved in the integer byte (000 to 111) with decimal values from 0 to 7.

The response bits for this input fall (referring to the binery "place" chart) in the 512's, 1024's, and 2048's place. Likewise, the patterns appear as in Table 4.

All are multiples of 512, so the command $A = (A-1) \times 512$ sets up the correct bits. In this case, assume that the user's choice was number 6, resulting in a bit pattern of 101 in the appropriate integer's positions. The OR function is used again in line 410, but recell that Q already has been assigned a value in line 300:

```
O new value = 111 0000 0000 0000
A now selected = 000 1010 0000 0000
O OR A function = 111 1010 0000 0000
```

What is the resulting Q at this point? You can celculate it by adding the sum of the powers of two, as above, and you will discover the integer is now 31232. Or, more simply, you can hit the Break key and enter the command: PRINT Q. 31232 will be the result.

The yes or no questions are simpler. If the enswer to a question is yes, its respective bit is set to 1. If the enswer is no, that bit is set to 0. The enswers to the six questions in this exemple are packed into integer Q in lines 610–620, 660–670, 710–720, 860–770,810–820, and 860–870. For exemple, assuming a yes enswer to question 4, variable A would be set to 32, then ORed with Q. Notice that if you wish to pack the answers to 15 yes or no questions into a single integer (instead of multiple-selection responses), this method can be used easily.

The final three bits of integer Q hold the results of another eight-answer ques-

```
810 AS-INKEYS: 1F AS-"Y" THEN A-16
ELSE IF AS-"N" THEN A-8 ELSE
810
829 Q-Q OR A
830 GOSUB 1386
840 FINT QUESTION $6****
850 GOSUB 1420
                                                                                                                                                                                                                                                                                                     868 AS=INKEYS: IF AS="Y" THEN A=8
ELSE IF AS="N" THEN A=8 ELSE
860
                                                                                                                                                                                                                                                                                                ELSE 17 ** TRANS GT ** TRANS GT **

876 Q=0 OR A
680 GOSUB 1369
879 PRINT ** INPUT PHASE IS COMPLETE.**
980 PRINT ** CODE NUMBER = ";
910 OS=RIGHTS (STRS(Q)) - LEM(STRS(Q)) - 1)
920 PRINTSTRINGS (S-LEM(S), "8") : JGS."
933 PRINT ** DECODING IMPORMATION:
R=8+1
948 R=0; R=R AND 28672 | R=R/4996 :
R=8+1
956 PRINT *CONTACT: ",
960 ON R GOTO 976,999,999,1868,1818,
1826,1834,1946
976 PRINT ** PRINTS ORGANIZER* : GOTO 1858
980 PRINT ** PRINTS ORGANIZER* : GOTO
1858
1858 PRINT ** RESTIVAL PARTICIPANT* :
GOTO 1858
1868 PRINT ** FESTIVAL PARTICIPANT* :
GOTO 1858
                                                                                                                                                                                                                                                                                                   GOTO 1050
1818 PRINT "FESTIVAL ATTEMDEE" :
                                                                                                                                                                                                                                                                                                   GOTO 1059
1020 PRINT "BENEFIT CONTRIBUTOR" ;
                                                                                                                                                                                                                                                                                                   GOTO 1050
1038 PRINT "MISCELLANBOUS" : GOTO
                                                                                                                                                                                                                                                                                                 1038 PRINT "MISCELLANEOUS"; GOTO 1859
1848 PRINT "CRESERVED>"
1858 PRINT "CRESERVED>"
1858 PRINT "RESERVED>"
1868 R=Q; R=R AND 3584; R=R/512; R=R+1 PRINT"
1878 PRINT "CATEGORY; ";
1888 R=Q; R=R AND 7; R=R+1
1898 ON R GOTO 1189,1128,1138,1148,1158,1168,1178
                                                                                                                                                                                                                                                                                                   1100 PRINT "VISUAL ASTIST" : GOTO
                                                                                                                                                                                                                                                                                                   1188
1118 PRINT "DESIGNER": GOTO 1188
1128 PRINT "COMPOSER": GOTO 1188
1138 PRINT "VIDEO ARTIST": GOTO
                                                                                                                                                                                                                                                                                                  1180
1140 PRINT "DANCER/CHOREO" : GOTO
                                                                                                                                                                                                                                                                                                   1150 PRINT "SCULPTOR" : GOTO 1188
1160 PRINT "PERF, MUSICIAN" : GOTO
                                                                                                                                                                                                                                                                                              1106 PRINT "UNCATEGORIZED": GOTO
1176 PRINT "UNCATEGORIZED": GOTO
1188
1189 RAQ : RAR AND 256 : IF R=256
THEN PRINT "Y ELSE PRINT "N"
1298 RAQ : RAR AND 256 : IF R=256
THEN PRINT "Y ELSE PRINT "N"
1208 PQ : RAR AND 128 : IF R=128
THEN PRINT "Y ELSE PRINT "N"
1208 PQ : RAR AND 128 : IF R=128
THEN PRINT "Y ELSE PRINT "N"
1240 PRINT "QUESTION 64 : IF R=62
THEN PRINT "Y ELSE PRINT "N"
1240 PRINT "QUESTION 44: "N"
1240 PRINT "QUESTION 45 : "N"
1240 PRINT "QUESTION 55 : "N"
1257 RAQ : RAR AND 32 : IF R=32
THEN PRINT "Y ELSE PRINT "N"
1268 PRINT "QUESTION 55 : "N"
1268 PRINT "QUESTION 56 : "N"
1278 RAQ : RAR AND 16 : IF RAB THEN
1288 PRINT "QUESTION 56 : "N"
1288 PRINT "QUESTION 56 : "N"
1280 PRINT STENGS(27,45)
1336 PRINT STENGS(27,45)
1336 PRINT STENGS(27,45)
1336 PRINT STENGS(27,45)
1338 CLS : PRINT STRINGS(27,45)
1338 CLS : PRINT STRINGS(27,45)
1338 CLS : PRINT STRINGS(27,45)
1348 PRINT STRINGS(27,45)
1416 RETURN
1428 PRINT STRINGS(27,45)
                                                                                                                                                                                                                                                                                                  1100 PRINT "UNCATEGORIZED" : GOTO
                                                                                                                                                                                                                                                                                                 1416 RETURN
1428 PRINT STRINGS(27,45)
1438 PRINT STRINGS(27,45)
1438 PRINT STRINGS(27,45)
1458 RETURN
```

```
Program Listina 1
```

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80 APPLICATIONS

tion, and the process (which I won't describe this time) is carried out in lines 420 through 570 of Listing 1.

Getting It Back

Once the information has been packed into integer Q (which will be a number from 0 to 32767), how is it retrieved? Lines 900-920 print the number on the screen in five-digit format, merely for convenience. Its decoding follows,

employing another logical function: AND.

In brief, if bit X is 1 and bit Y is 1, then the result of the function X AND Y will be 1. Any other combination of X AND Y will result in a 0. Look at line 940, which uses the AND function in the commend R=Q: R=R AND 28672. Remember that et this point Q is the coded integer conteining a lot of information; by making R equivalent to Q, value Q cen be saved intact for

later use. So this value R (= Q) is ANDed with 28672. What is 28672? It is 16384 \pm 8192 \pm 4096. In other words, the value 28672 is en integer with the upper three bits already set to ones (111 0000 0000 0000). This is the key to recovering the information packed into Q.

The following example shows a possible coded number Q (decimel 22190) generated with this packing system. It is being ANDed with 28672, which will "mask out" all the bits we do not need to know ebout. Since everything ANDed with 0 will end up being 0, this method simply places zeros where they are needed in the masking integer:

O Integer being tested:	101 0110 1010 1110
28672 used as a mask:	111 0000 0000 0000
Executing O ANO 28672:	birritana
Resulting masked value:	101 0000 0000 0000

Any 1 bits in integer Q (22190) will fifter through the mask, giving a binary result. Converting the result to decimal gives the value 20480 in this example. The next command in line 940 is R = R/4096. Recail that value A in the input phase of the sample program was multiplied by 4096 to shift the bits into the high position of integer Q. Here is the reverse of the process, resulting in an integer with the value 0 through 7. Since the original choices were 1 through 8, the final commend on line 940 is R = R + 1. In this sample, R (= 22190) AND 28672 = 20480. R/4096 = 5. R + 1 = 6. Therefore, the information has been recovered, and it can now be stated that the original value input was sixty. It is only e simple matter (in line 960) to display what that original input choice means.

Line 1060 performs the same sort of activity to recover the response to the second input. Again, R=Q to recover the initial packed integer. Then R=R AND 3584, since 3584 equals 2048 + 1024 + 512 (enother three-bit mesk). R=R/512 shifts the values to 0 through 7, and R=R+1 returns the values 1 through 8. Diaplaying the original input is again almple. Here is the binary representation:

R (= 0):	101 0110 1010 1110
3584 Mask:	000 1110 0000 0000
R AND 3584:	
Recovered info	o: 000 0110 0000 0000

When ell this information is recovered, It's possible, by feeding in a five-digit code on someone's meiling label, to print out e report for your club or user's group which seys, "John Jones is a TRS-80

Not	000 I#1 Eight Resp.	000 I#2 Eight Resp.	Q#1 Yes	Q#2 Yes	Q#3 Yes	Q#4 Yes	Q#5 Yes	Q#6 Yes	000 I#3 Eight Resp.
-----	------------------------------	------------------------------	------------	------------	------------	------------	------------	------------	------------------------------

Table 1

1 6 3 8 4	8 1 9 2	4 8 9 6	2 0 4 8	1 0 2 4	5 1 2	2 5 6	1 2 8	6 4	3 2	1 6	8	4	2	1,	
ន	ន	s	ន	s	s	S	s	s	S	s	s	s	s	s	
P 1 a c e	P l a c e	P 1 a c e	P a c e	P 1 a c e	P 1 8 C e										
						-									

Table 2

		Bit Position:		(8) XXX	8000	0880	8080				
666	=	0	+	Ø	+	0	=	(8 (8	x	4096)
001	⇇	Ø	+	8	+	4096	=	469	6 (1	х	4096)
010	=	0	+	8192	+	8	=	819	2 (2		4096)
011	=	0	+	8192	+	4096	=	1228	8 (3		4896)
100	=	16384	+	0	+	0	=	1638	4 (4	х	4096)
101	=	16384	+	Ø	+	4896	=	2048	0 (5	x	4896)
110	=	16384	+	8192	+	8	=	2457	6 (6		4096)
111	=	16384	+	8192	+	4096	=	2867	2 (7	x	4896)

Table 3. Combination Chart

```
Bit Position = (0)000 XXX0 0000 0000
000
                                                     (8 \times 512)
001
            Α
                 +
                   Ø
                             512
                                              512
                                                     (1 x 512)
010
            8
                 + 1024 +
                              0
                                             1024
                                                     (2 \times 512)
011
            а
                 + 1824 +
                             512
                                             1536
                                                     (3 \times 512)
     =
100
           2048 +
                                             2048
                   0
                              а
                                                     (4 \times 512)
101
     =
           2048 +
                    0
                                             2560
                             512
                                                     (5 \times 512)
110
           2048 + 1024 +
                              в
                                             3072
                                                     (6
                                                        x 512)
           2048 + 1824 +
                             512
                                             3584
                            Table 4
```

Model III user with whom we made contact through another member. He has responded to each of our mailings, attended the last meeting, participated in the fles market, his dues are up to dete. Jones's specialty is assembly lenguage, and he participated in the club's last seminer." All in one two-byte Integer.

How to Hex

Okay, you eay, binery has its uses if I'm willing to spend some time and effort to use it. But why hexadecimal notation? Who ceres? Hexedecimel notetion, es e reflection of its binery function, can clearly demonstrate the relationships between machine functions. A very few of the 6809E instructions, commands which affect the operation of the Color Computer's central processing unit, are in Table 5.

Obviously, the easiest way to remember these instructions is by their mnemonics. But the TRS-80 cannot easily report back its memory contents in mnemonics, at least not without an extensive progremmer's aid called e disassembler. Therefore, when you see a bunch of numbers, ideally they should provoke some familiar reection. Numbers like 136, 152, 168, and 184 are not likely to emphasize their straightforward reletionship to each other. Examine instead Table 6, with those same four instructions (all sixteen forms) shown in mnemonics, decimal, binary, and hexadecimal.

See how nestly the leftmost digits count upward in binary? And notice how the commands count upward, in hex 10's, in that same neat way. The reletionships between the versions of ADC are visible, as are the relationships between the variants of EOR. Their nature is clearest in binary, but it is also eesily visible in hexedecimel-a far cry from attempting to guickly discern the relationship between 136 end 152, or 200 and 232.

Not impressed? Then how about an excerpt from Bill Berden's August 1981 Assembly Line. On page 49, e men with staggering insight named David Lamkins offered this remarkable binary-to-ASCII conversion routine (wish I'd thought of this one):

AUO	A,90F
DAA	
ACC	A,40H
OAA	

Let's try it first in decimal to see if it

Command Mnemonic	Description of Command's Action	Decimal Values
ADCA	Add to accumulator A, plus carry (instruction has four options)	137,153, 169,105
ADCB	Add to secumulator B, plus carry (instruction has four options)	201,217, 233,249
EORA	Exclusive OR accumulator A (instruction has four options)	136,152, 168,184
EORB	Exclusive OR accumulator B (instruction hae four options)	200,216, 232,248

Table 5. 6809E instructions

Mnemonic	Decimal Value	Binary Value	Hex Value
ADCA	137	1000 1001	89
	153	1001 1001	99
	169	1010 1001	A9
	185	1011 1001	В9
ADCB	201	1100 1001	C9
	217	1101 1001	D9
	233	1110 1001	E9
	249	1111 1001	F9
EORA	136	1000 1000	00
	152	1001 1000	90
	168	1010 1000	Aθ
	184	1011 1000	BØ
EORB	200	1100 1000	CØ
	216	1101 1000	D8
	232	1110 1000	ΕØ
	240	1111 1000	FB

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makes sense. Add 144 to the eccumulator, decimal adjust the accumulator (for base ten operations), add 64 to the accumulator plus the contents of the carry flag, and decimal adjust the accumulator again. Hmm. Let's convert decimal 14 to ASCII with it. 144 + 14 = 158. Decimel adjust. From what? The Z80 assembly programming guide talks in terms of hex values in upper and lower digits, but I've converted it to decimal equivalents for this example. Take my word that DAA would add 102 to this value, resulting in 260. Since the maximum value is 255, this 260 must have actually produced four and set the carry flag. Add 64, with carry, to the accumulator produces 69-the ASCII code for uppercase letter E.

Was that clear? I really didn't try to murky it up at all; it's just the best that can be done in decimal terms. Now hare's the same conversion of 0E (decimal 14) to ASCII using haxadecimal notation. 90H + 0EH = 9EH. Decimal adjust. The programming guide says if 9-F is in the upper digit and A-F is in the lower, decimal adjust (DAA) adds 66H to

this result. 9EH + 66H = 104H, with the leftmost 1 ending up in the carry flag. Add 40H, with carry, produces 04H + 40H + 1 = 45H—the ASCH code for letter E.

Any clearer? Obviously, since the programming guide forces you to use hex digits to determine the decimal-adjusted results, that consideration is simpler. But also, notice that decimal 256 is actually 100 hex—in terms of the accumulator, it is 00 with the 1 carried over. That's why 260 decimal produces a result of four with carry, not five, it just isn't visible to the eye in decimal notation, whereas hexadecimal makes it very certain that a carry has taken place.

I've jumped to the defense of hexadecimal notation not because I'm a longtime programmer rigidly committed to it (i'm neither), but rather because it's essential to understanding what your computer is doing, if understanding is what you care to do. Sure, numbering systems are arbitrary, and it's unfortunate that we're stuck with binary notation and digital logic to start with. But it's currently an economic fact of life for

computers; even if computers move awey from binery operation, your TRS-80 Model i, II, Iii, Color Computer, Videotex, Pocket Computer—or your Apple, OSI, Pet, Northatar, Atari, Vic, or Compusquat—is a digital device. That's its nature, so that becomes your problem to deel with in the least time-consuming manner.

What VAR is that VARPTR PTRing to?

One more exemple; heng in there with me. Most programmers end up being forced to write sorting programs. Aside from being an unsatisfying project, sorting programs written in Basic can be dreadfully slow. Normally, sorting is done by comparing one item with another in some manner, and switching those items. But if the items are very long (such as names and addresses or other long strings), the sorts can take hours to complete.

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match the numbered reference labels. Would you (a) move the artwork to metch the labels, or (b) move the labels to match the artwork? Assuming there has been no artistic decision involved in rearranging the cetalog, it's probably a lot easier to move a label instead of, perheps, a two-ton piece of sculpture.

This relates directly to sorting programs. Every variable is located by Basic by means of a variable table it builds and stores just after the program listing. Your computer can provide you with that information by means of the commend VARPTR (variable pointer). If variable R\$ has been defined, then command PRINT VARPTR(R\$) will return the decimal value of the eddress et which ell the information about R\$ is stored.

If PRINT VARPTR(R\$) yields 8591 on the Color Computer, then PRINT PEEK(8591) will reveal the length of R\$, and PRINT 256×PEEK(8593)+PEEK (6594) will tell where R\$ starts in memory. For example, in the Color Basic version of Babybug, the command PRINT VARPTR(R\$) might in fact yield 8591, PEEK(6591) = 2, end 256×PEEK(8593)

+ PEEK(8594) = 16381. Interestingly, you will find that the formidable question—

FOR X = 1 TO PEEK (VARPTR (R\$)) : PRINT CHR\$ (PEEK (256 \times PEEK (VARPTR (R\$) + 2) + PEEK (VARPTR (R\$) + 3) + X - 1)); : NEXT

—will actually print R\$ on the Color Computer! On the Model I or III, one espect would be reversed, and the equation would read:

FOR X = 1 TO PEEK (VARPTR (R\$)): PRINT CHR\$ (PEEK (PEEK (VARPTR (R\$) + 1) + 256 \times PEEK (VARPTR (R\$) + 2) + X - 1)); NEXT

What is this 256 × PEEK(N) + PEEK (N + 1) business? Because there are so many memory locations in the computer, any given location must elways be epecified using sixteen binary digits of deta—one group of eight bits defines the most algnificant byte (MSB), or highest eight binary digits, and the other group defines the least algnificant byte (LSB) of the address. You will recall that integers were also stored as two bytes of informe-

tion, so this type of format is not new. What is new, at least in the Model I or III TRS-80a, is how this information is ordered.

Because of choices made when the original 8006 microprocessor was designed in the early 1970's, its grend-child the Z80 stores eddresses with the LSB first and the MSB second. Fortunately, users of the Color Computer will find that the 6809E processor keeps things in a more human-oriented order, with MSB first and LSB second. In both cases, though, the lower eight bits can be used as written, but the upper eight bits occupy the 256's place through the 32768's place. Therefore, the number represented by this byte is actually 256 times that of the least significant byte.

Now to the point. If I PEEK into the Model I's memory and find that an address is given as 233 decimal, 66 decimal, I can calculete the true address with the formula LSB+256×MSB, or 233+66×256. That is 17129, which many of you will recognize as the beginning of Besic program storage. If I PEEK into the Color Computer's memory end find an

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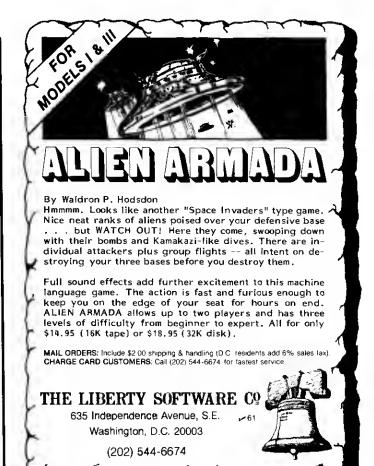
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addrass written 30 dacimel, 0 decimal, I can calculate that address as

 $256 \times MSB + LSB$, or $256 \times 30 + 0$. That is 7680, also the beginning of Besic.

```
18 REM * THIS PROGRAM DEMONSTRATES
28 REM * A BUBBLE SORT WRITTEN WITH
38 REM * BOTE NORMAL REPLACEMENT
48 REM * SORTING AND NITH VARPTR
58 REM * REPERENCE POINTER SWITCHING
68 CLEAR250:CLS:PRINT STRING$(27,45)
78 PRINT "<V>ARPTR STRING SORT"
98 PRINT "<V>ARPTR STRING SORT"
98 PRINT TOUCE N OR V."
118 PRINT "TOUCE N OR V."
                                                                                                  268 PRINT "<SORTED - TOUCH ENTER>"
278 A$=INKEY$: IP A$=CBR$(13) THE
                                                                                                                                     IP AS=CERS(13) THEN
                                                                                                             10 ELSE 270
                                                                                                  290 REM
300 REM
                                                                                                  348 DEFINTX,Y,Z,I,K,L,N,N,Q,D,E:
Y=8: Z=6: D=1: E=2: K=6:
L=6: N=6: N=6: Q=6: X=6
98 PRINT STRINGS(27,45)
188 PRINT STRINGS(27,45)
128 A$=INKEY$ : IP A$="N" THEN 138
ELSE IF A$="V" THEN 288 ELSE
                                                                                                 328 INPUT"BOW NAMY 1TEMS TO SORT";1
338 DIN A$(1): POR X = 1 TO 1:
PRINT X; INPUT A$(X): NEXT:
GOSUB 448
348 PRINT"<... NOW SORTING ...>";
358 GOSUB 448; REM REMOVE TO TIME
366 X=D:N=R+D:Q=#

376 IPAS(X)<=AS(X+D)THEN396

386 Q=Q+D:Z=VARPTR(AS(X)):X=PEEK(Z):

L=PEER(Z+D):N=PEEK(Z+E):Y=VARPTR
158 REM
168 INPUT HOW NANY ITEMS TO SORT";1
178 DIM AS(I) : FOR X = 1 TO I :
PRINT X; : INPUT AS(X) : NEXT :
                                                                                                             (A$(X+D)):POREZ,PEER(Y):POREZ+D,
PEER(Y+D):POREZ+E,PEER(Y+E):PORE
 GOSUB 448
188 PRINT "< ... NOW SORTING ... > 198 GOSUB 448 : REM REMOVE TO TIME
                                                                                                          Y,R:POREY+D,L:POREY+E,M
X=X+D:IFX>I-1THEN400ELSE370
 200 X=1:N=N+1:Q=0
                                                                                                  488 IFQ=8TREN418ELSEIFX>I-1THEN358
ELSE378
218 IFA$(X) <=A$(X+1) THEN238
228 Q=Q+1: Z$=A$(X): A$(X)=A$(X+1):
                                                                                                  ELSE378
418 GOSUE 448
428 PRIRT "<SORTED - TOUCH ENTER>";
438 A$=INKEY$; IF A$=CHR$(13) THEN
18 ELSE 438
44 CLS. POR Y = 2 TO "
 A$(x+1)=Z$
238 X=X+1:IPX>I-1THEN248ELSE218
 248 IPQ=STHEN258ELSEIPX>1-1THEN198
            ELSE210
                                                                                                  448 CLS : FOR X = 1 TO I
458 PRINT A$(X) : NEXT X : RETURN
 250 GOSUB 440
```

Program Listing 2

```
* Babybug II for Model I/III *
           Program memory requirement: 848 bytes
Running time requirement: 162 bytes
        Hasic normal overhead requirement: 83 bytes
  Memory Size can be set to total memory minua 1100 bytea
1 CLEAR4: DEFINTD-Y: DEF SNGQ: E=1:F=256:G=16:H=40:I=55:J=64
2 CLS:INPUT"ORG MSH"; R$:GOSUB13:POKE16527, M:L=M:INPUT"ORG
    LSH"; R$: GOEUH13: POKE16526, N: K=M: Q=K+F*L: IFQ>32767THEN
3 PRINT*ENTER REX HYTES (X = STOP S = SKIP)
4 FORY=ETO8:GOSUB19:FORW=ETOG
5 P=260+3*W+(Y-E)*J:PRINT@P,CHR$(91);
6 R$="":INPUTR$:IFR$="X"THEN12ELSEIFR$="E"TREN9ELSEIFR$=""
    TREN7ELSEGOSUB13: POKEQ, M
 Q=Q+E:PRINTCHR$(27) CHR$(30);:PRINT@P-64,R$;:K=K+E:IFK<F
    TRENSELSEK=8:L=L+E
  NEXTW: PRINT: GOSUB20: GOTO11
9 PRINTCHR$(27);:FORX=QTOQ+(G-W):K=K+E:IFK<FTHEN1@ELSEK=@:
    L=I+E
10 NEXTX:Q=Q+17-W:GOSUB21:GOSUB20
11 NEXTY: CLE: PRINT: PRINT: PRINT: GOTO4
12 INPUT"1 = RUN PROG, 2 = RE-ENTER"; 5: IFS<>1THEN2ELSEPRINT
    USR(0):GOTO12
13 R=ASC(RIGRT$(R$,E)):S=ASC(LEFT$(R$,E))
14 1FR>47ANDR<58THENT=R-HELSEIFR>JANDR<71THENT=R-I
15 IF5>47AND5<58THENU=G*(S-H) ELSEIFS>JANDS<71THENU=G*(S-I)
16 M=T+U:RETURN
17 N=V/F:O=V-N*F:N=O/G:D=O-N*G:IFN>9THENPRINTCHR$(I+N);:
    ELSEPRINTCRR$ (H+N);
18 IFD>9THENPRINTCHR$(I+D);:RETURNELSEPRINTCHR$(B+D);:
    RETURN
19 GOSUB21:FORX=QTOQ+15:V=PEEK(X):GOSUB17:PRINT ";:NEXT:
    PRINT: RETURN
20 PRINTCHR$(27) TAB(7);:FORX=Q-GTOQ-E:V=FEEK(X):GOSUH17:
    PRINT *; NEXT:PRINT:RETURN
21 V=L:GOSUB17:V=K:GOSUB17:PRINT" * ";:RETURN
```

Program Listing 3

Howavar, thasa time-consuming convarsions era eesiar for me bacausa I think in hexadecimal; I can do it in my haad, sinca I only need to know the onebyte hax-to-dacimel conversions. With practice, these one-byte conversions ere eesier to remember than multiplying by 256. My decimal 233, 66 address mantioned eerlier turns into E9 42 hex, which (bacausa It's storad backwards in Z80 terms) becomes eddress 42E9. In the Color Computer, decimai 30, 0 bacomes 1E00 hex, which is eireedy in the proper ordar. And sinca tha Modal I's disk and Level III Basic packages elf Include the &H option for hax numbers, I need convert no further. Extended Color Basic elso includes &H as standard equipment (as wall as HEX\$-raad on).

Toll and Troubla

There is a reeson I brought up all these addrassing confusions: lika switching the cetalog lebels under the pieces of art, It's festar to switch the VARPTR labels to variables rather then the variables themselves. Progrem Listing 2 shows two ways of doing a simple bubble sort on the Modal I. The normal sort starts et line 140, avaiuatas each Itam in tha list ageinst the next item in the list, and switchas them (lina 220) if they ere out of ordar. A flag is sat (variable Q) any time itams in the ilst are switched; when ell hava bean switched, Q is zaro, and a completion message is printed. This sort assantially moves ell the ertwork every time the sort is passed through.

The VARPTR sort begins at lina 290, defines all veriebles (to set aside all necassary space in the VARPTR teble). and sterts in much tha sama way as tha usual bubble sort: an item is evalueted egainst the next one in tha list. Than things begin to changa: Line 380 is pecked tightly to speed up the oparation. Z is set to VARPTR(A\$(X)), the eddress at which information ebout the current item being sorted is stored. Verlables K, L and M ere given the information about tha Item under consideration-its langth, and where it currently resides in memory. Y is than sat to VARPTR(A\$(X + 1)), that eddress et which information ebout that next item in the list is stored. A\$(X) is POKEd with PEEK(Y), PEEK(Y + 1), and PEEK(Y+2), meening the information about A\$(X+1) is being POKEd into A\$(X). Likewisa, A\$(X + 1) is POKEd with K, L and M, the storaga Information about A\$(X). The computer cen now be fooled into believing A\$(X) is A\$(X+1)and vice-versa. This line has switched the labels, not the ertwork.

Is it worth the troubla? That dapends

on the length of the sort you are doing. The fewer the Items in the sort, the less advantage the VARPTR method will have. Table 7 compares the two sorting techniques.

It's clear that when memory space is at a premium, as it probably would be with large amounts of data to be sorted, the VARPTR method has a remarkeble advantege-sorting 50 four-character strings in less then helf the time an or-

dinary sort would need. It can also avoid potentially disastrous out-of-stringspace errors.

The cause of the delay during sorting, by the way, is something cailed "garbage collection." When small computers such es the TRS-80 menipulate atrings (such as the command Z\$ = A\$(X) in Listing 2), temporary string space is set up for Z\$. Each time Z\$ is used this way again, new space is set up for it, and the old version

of Z\$ is abendoned. It's still there in memory, but it's inaccessible end the memory space is lost (temporarily!). Why would enyone creete a Basic that did this? The answer is really quite reasonable: Since your TRS-80 Besic doesn't require you to define how long any atring la going to be before you use it. Basic can't know aheed of time. If it was forced to use the same location to store Z\$ every time, and Z\$ got longer, it just wouldn't fit. To avoid any such conflicts, every time a string is defined—even if it has the same variable name—new space is set aside for It.

However, Basic has to recover this deed spece sometime, end that process is called garbage collection. When Cleered string space is used up, operation of your running program is suspended, and Basic picks Its way through string storage memory, cleaning out the dead strings and moving the live strings into those areas. When there are hundreds of strings involved. Basic has to check eech and every one against its entire VARPTR table to see if It's elive or dead. Thet process can take up to an hour In complicated programs.

With the VARPTR sort, there is no gerbage collection during the sort, because no string equations ere used—only numerical pointer switching! That accounts for the remarkably consistent time for sorting, irrespective of the length of the items being sorted. The normal sort, on the other hand, takes longer and longer as it is required to pick up its garbage more often.

In Listing 2 I've only cleared a small emount of space (in line 60); if the cleared space were larger, the normal program would beat the VARPTR sort. But don't forget thet most sorting programs will use massive amounts of data, thereby limiting the emount of string spece you cen clear. If you have e sorting program that runs e long time, try re-writing it with the VARPTR sort. It might save you a couple of hours.

At Laet

The purpose of this month's column (several thousand words ago) was to present again the Babybug machine-lenguage monitor. Here is a brief description of the major ections of each version of this progrem.

in Program Listing 3 (the Model I or ill version), atring space is reduced to a minimum, and integers and other values are defined. The input prompts for mostsignificant and least-significant address bytes are presented, and the input atrings are converted to numbers and

Number of	Length of	Normal	VARPTR
Items	Items	Sort Time	Sort Time
38	1	8:34	0:49
38	3	8:36	0:49
30	5	8:47	8:58
38	7	1:39	8:51
30	8	OS ERROR	Ø:53
38	9	OS ERROR	OS ERROR
58	1	1:55	2:46
50	3	2:53	2:58
50 -	4	5:38	2:51
50	5	OS ERROR	OS ERROR

* Babybug for Color Computer, 4K Color Basic * Program memory requirement: 864 byte Running time requirement: 225 bytes 864 bytes Basic normal overhead requirement: 188 bytes Clear memory to total available minus 1197 bytes (CLEAR 8,2758)

- 1 CLEAR8:E=1:F=256:G=16:B=48:I=55:J=64
- 2 CLS:INPUT"ORG RSB";R\$:GOSUB13:L=H:INPUT"ORG LSB";R\$:GOSUB 13:K=M:Q=K+F*L:ZN=Q:PRINT*ENTER HEX BYTES. X=STOP, S= SKIP
- 3 FORY=E TO8:GOSUB21:FORW=E TO8
- P=125+3*W+(Y-E)*32:PRINT@P, " "
- 5 R\$=**:INPUTR\$:IFR\$="X"THEN12ELSEIFR\$="S"THEN9ELSEIPR\$="" THEN7
- PRINT@P-25,R\$;:GOSUB13:POKEQ,H
- Q=Q+E:PRINT@Y*32+71, **;:K=K+E:IFK<F TREN8ELSEK=8:L=L+E
- 8 NEXTW:GOSUB22:GOTO11
 9 PRINT@Y*32+71, "";:FORX=Q TOQ+(8-W):K=K+E:IFK<P TREN18ELSE K=0:L=L+E
- 18 NEXTX:Q=Q+9-W:GOSUB22
- 11 NEXTY: CLE: PRINT: PRINT: PRINT: GOTO3
- 12 INPUT*1 = RUN PROG, 2 = RE-ENTER2; Z:IFZ<>1THEN2ELSEEXEC ZN:CLS:GOTO12
- 13 R=ASC(RIGHT\$(R\$,E)): E=ASC(LEFT\$(R\$,E))
- 14 IFR>47ANDR<58THENT=R-H ELSEIPR>J ANOR<71THENT=R-I
- IFS>47ANDS<58TRENU=G*(S-R)ELSEIPS>J ANDS<71TBENU=G*(S-I) 15
- 16 M=T+U:RETURN
- 17 A=INT(V/F):B=V-A*P:C=INT(B/G):D=B-C*G
- 18 IPC>9TRENPRINTCBR\$(I+C); ELSEPRINTCRR\$(B+C);
- 19 IFD>9THENPRINTCRR\$(I+O);:RETURNELSEPRINTCHR\$(R+O);:RETURN
- 28 RETURN
- 21 GOSUB23:FORX=Q TOQ+7:V=PEEK(X):GOSUB17:PRINT ";:NEXTX: PRINT: RETURN
- 22 PRINT@Y*32+71, "";:FORX=Q-8TOQ-E:V=PEEK(X):GOSUB17:PRINT ";:NEXTX:PRINT:RETURN
- 23 V=L:GOSUB17:V=K:GOSUB17:PRINT * ";:RETURN

Program Listing 4

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POKEd into the machine-language USR entry point. Variable Q is set to the current address being inspected; if Q is greater than address 32767, Level II Basic requires that it be converted to a negative number.

The user is then given a short menu of options (to enter hexadecimal bytes, to stop entry, or to skip the current line). The target address and the memory contents of it and 15 successive locations are displayed in hex. An arrow prompt points to the first hex byte. The options are (enter) to move on to the next byte; S (enter) to redisplay the first line and display the next one; X (enter) to terminate entry and present a new prompt; or the entry of any hexadecimal byte from 00 to FF.

A total of eight lines (128 bytes) may be displayed at any time; advancing to the next memory location clears the screen and presents a new line of information.

The X command (terminate entry) presents a new prompt asking the user either to run the machine code which has just been entered, starting at the initial entry address (the response to the MSB/LSB prompt), or to re-enter at a new address and begin the process again.

Major subroutines include hexadecimal string to numeric conversion (lines 13-16), integer to two-character hex string conversion (lines 17-18), full line display (line 19), revised line display (line 20), and address display (line 21).

The programming for the Color Basic version (Program Listing 4) differs from the Model I or III Babybug in two ways: the lack of the DEFINT function requires that integers be taken during calculation (line 17), and the absence of a USR function demands that the EXEC routine be used instead (line 12), Minor differences include the absence of an upward carriage return, and a required space

separating variable names from subsequent keywords (line 3, for example). The display is similar but not identical because of the 32-character line limit on the Calar Computer; anly eight bytes of hex data are displayed per line (64 per

The Extended Color Basic version of Babybug (Program Listing 5) is similar but faster than the Color Basic program because of the excellent HEX\$ command. The entire numeric-to-hex-conversion process is handled by the command V\$ = HEX\$(V) in line 17. The only modification I've made is the addition of a leading zero in front of single-digit hex numbers. A DEFUSR function is used instead of EXEC.

Sample Session

Enter Babybug in Basic, and be sure to save a copy to tape before you run it, as random entry of hex information into memory can crash everything. After saving and verifying a copy, run the program. The screen will clear and this prompt will be displayed: ORG MSB?__. It is asking for the most significant byte of the address you wish to inspect, a two-digit hexadecimal number. For this first session, the screen will be examined. Enter-3C (04 on the Color Computer). The next prompt will be: ORG LSB?__. This asks for the least significant byte of the address to be examined. Enter 00 (00 on the Color Computer). The short menu (Enter-Hex Bytes. X = Stop, S = Skip) will be displayed, followed by the complete address (3C00 or 0400) and sixteen (eight) hexadecimal bytes of data.

The first three bytes will likely be 4F 52 47. No, this is not machine code yet. These are the ASCII values for the first three letters at the top left of the screen-ORG. Type: 41 (enter) 42 (enter) 43 (enter). The bytes displayed should change as you enter each one, and the characters at the top left corner of the screen will change to ABC. Continue to enter hex data from 00 to FF and observe the screen display change. As you reach the end of the line, a new line will be displayed with the continued screen information. When you have entered 128 bytes (84 on the calar camputer), the screen will clear and the hex display will be continued.

Now type X (enter). You will see the prompt 1 = RUN PROG, 2 = RE-ENTER.Type 2 (enter). The acreen will clear again, and the entry (origin) prompt will reappear. Before continuing, make sure you have saved a copy of the program! Enter 00 (A0 in Color Basic, 80 in Extended Color Basic) to MSB and 00 to

Model I/III: 21 00 3C CD 2B 00 28 PB FE 0D C8 77 23 C3 03 70 Color/Ex Col: 8E 04 00 BD A1 71 81 0D 26 01 39 A7 80 7E 0E 03

Table 8

* Babybug for Color Computer, 16K Extended Color Basic * Program memory requirement: 884 bytes Running time requirement: 190 bytes Basic normal overhead requirement: 88 bytes Clear memory to total available minua 1082 bytes (PMODE8: PCLEAR1: CLEAR8, 4288) 1 CLEAR8:E=1:F=256:G=16:H=48:I=55:J=64

2 CLS:INPUT"ORG MSB";R\$:GOSUB13:L=M:INPUT"ORG LSB";R\$:GOSUB 13:K=M:Q=K+P*L:DEFUSR8=Q:PRINT"ENTER HEX BYTES. X=STOP S=SKTP

3 FORY=E TO8:GOSUB19:FORW=E TO8

P=125+3*W+(Y-E)*32:PRINT@P, " "

5 RS="":INPUTR\$:IFR\$="X"THEN12ELSEIFR\$="S"THEN9ELSEIFR\$="" THEN7

6 PRINT@P-25,R\$;:GOSUB13:POKEQ,M

Q=Q+E:PRINT@Y*32+71, "";:K=K+E:IFK<F THEN8ELSEK=8:L=L+E

8 NEXTW:GOSUB28:GOTO11

9 PRINT@Y*32+71, "";:FORX=Q TOQ+(8-W):K=K+E:IFK<F THEN1@ELSE K=0:L=L+E

10 NEXTX:Q=Q+9-W:GOSUB20

- 11 NEXTY:CLS:PRINT:PRINT:PRINT:GOTO3
- 12 INPUT"1 = RUN PROG, 2 = RE-ENTER"; Z: IFZ <> 1THEN2ELS EPRINT USR8(0):CLS:GOTO12

13 R=ASC(RIGHT\$(R\$,E)):S=ASC(LEFT\$(R\$,E))

- 14 IFR>47ANDR<58TNENT=R-H ELSEIFR>J ANDR<71THENT=R-I
- 15 IFS>47ANDS<58THENU=G*(S-H)ELSEIFS>J ANDS<71THENU=G*(S-I)

16 M=T+U:RETURN

17 V\$=HEX\$(V):IFLEN(V\$)=lTNENPRINT*8*+V\$;ELSEPRINTV\$;

18 RETURN

- 19 GOSUB21:FORX=Q TOQ+7:V=PEEK(X):GOSUB17:PRINT" ";:NEXTX
- PRINT: RETURN 20 PRINT@Y*32+71, "";:FORX=Q-8TOQ-E:V=PEEK(X):GOSUB17:PRINT ";: NEXTX: PRINT: RETURN
- 21 V=L:GOSUB17:V=K:GOSUB17:PRINT * ";:RETURN

Program Listing 5

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80 APPLICATIONS

LSB. The acreen will now displey the opening hex bytes of Basic. This is mechine language, and this is e machine language program that you are going to run. Type X (enter), and in response to the run/re-enter prompt, type 1 (enter). You will see your computer's sign on message—Memory Size? or MEM SiZE? for Model II; Color Basic 1.0 or Extended Color Basic 1.0. Babybug has been creshed, and your computer looks like you just turned it on.

Now reload Babybug (you did save it, right?), and run it. Respond to MSB and LSB with 70 and 00 (0E 00 on the Color Computer). Enter the bytes in Table 8 one at a time.

Enter X. Now run this progrem by responding 1 to the prompt. Nothing? Begin to type. Letters ere displayed on the screen, sterting et the top left corner. But no, you are not in Basic. This is e machine-language progrem which (a) calls a Basic keyboerd scan routine, (b) checks for the enter key—carriage return code 0D hex—returning to Basic if it finds it, end (c) puts the typed charecter in screen memory.

You'll notice some interesting things when you begin typing with this routine. There is no cursor following the letters, since this program doesn't invoke a cursor display routine. Also, things like shift and shift lock (shift-0) produce odd characters on the Color Computer, end the backspace displays an H on elimachines.

Here's a look at the hex code and what it does. The Model I or III program loads register HL with screen address 3C00 (21 00 3C), calls the ROM keyboard Input routine (CD 2B 00), loops back to the keyboard routine if the velue returned from the keyboard is zero (28 FB), comperes to see if it is a cerriage return (FE 0D), returns to Basic if it is e cerriage return (C8), otherwise puts the character on the screen (77), moves to the next screen position by incrementing HL (23), and loops back to do the whole thing over (C3 03 70).

The Color Computer program loads the X register with the screen eddress 0400 (8E 04 00), calls the Color ROM keyboard routine (BD A1 71), checks if the velue is a cerriege return (81 0D), jumps ahead one

place if it lan't a carriage return (26 01), otherwise returns to Basic (39). When it jumps ahead with a character, it puts it in screen memory (A7 80), and loops back to do it again (7E 0E 03).

The Z80 and the 6809E ere different processors with unique properties; yet it's revealing to notice how similar these processes ere, and even to compere them instruction-for-inetruction. Although the hex codes ere different, many of the properties are the same.

You're tired of testing and want something substantial? That's up to you. I will be happy to publish interesting routines created in hex code, as well as some of your experiences in developing them in hex notetion alone. (No cheating, assembly language users!).

Updates

Look for some minor corrections and suggestions to the high resolution graphics board for the Model I (The Deteiler, July) in next month's issue.

A printed circuit board is available for the Micro Front Panel (Mey). Write to me at Roxbury, Vermont 05669. ■

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"Of all software packages, a financial report preparation package can be most valuable..."

Of ell microcomputer software packeges available, a Financial Report preparation package can be the most valuable to an accountant. The use of a microcomputer system to prepare these reports can be an enormous time saver.

Without a microcomputer report praparation requires an enormous amount of affort. First, a hand written report must be prepared and reviewed by the audit partner. Then a copy must be typed, proofed and compared to the original. Finally the whole report must be subject to an independent review. If a last minute change is required, the whole process of proofing must be repeated. Needless to say, the opportunity for an emberressing error to occur is quite high.

The alternative of using a microcomputer to minimize this risk has been the root of the many requests I have received for information about report preparation systems. However, all the reports I heve seen were part of Generel Ledger peckages and were limited to an income statement end balance sheet. Reports such as the Statement of Reteined Earnings, Changes in Financial Position, Analysis of Changes in Working Capitel and Cash Flow Statement were missing. These reports are required to conform to professional standards.

Since the report is aften used by third parties the stendards of disclosure are higher then reports prepared for Internal use. As a result, the reporting system must accommodate date such as footnotes where explanations of complex trensactions or accounting policies must be presented. Although summary data may be adequate for outsiders, many clients require detailed financial reports for their own use. Thus many accountants prepare, in eddition to summary reports, detailed departmental and comparative reports. These supplementary reports are usually presented in an appendix to the main reports.

New General Ledger System

The new three-disk General Ledger system (#26-4601) has been designed to cope with the problems of the professional and yet be usable in a small busi-

ness environment. The ledger is designed to integrate with the other three disk systems, Accounts Receivable (#26-4604), Accounts Payable (#26-4605), and Payroll (#26-4603). If these other systems are used, summary data can be transferred at the month's end without the need for menual journel entries. The system has the cepacity to handle up to 400 general ledger accounts and 4300 year-to-date transactions.

It is supplied on seven disks, three of which contain programs, and four data files. Two of the data files contain a sample general ledger with ell accounts and reports previously defined. These sample data files are intended to provide a practice set for the owner of the system to use and become acquainted with. They are quite useful. The procedures to define accounts and output reports are complicated and the examples of data files that already work are helpful for reference purposes.

The program disks are errenged so that file maintenance programs are contained on progrem disk two and date entry progrems are contained on disk one. This provides a sound method for separating file maintenance and up-date functions for general ledger processing. If these functions are separated, proper internel control over the ledger should be established.

Once a decision is made to automate general ledger processing, serious thought should be given to the arrangement of the output reports and the content of the financial statements prior to setup. Once installed, changes will be quite painful. The system contains en enormous amount of data. Balances ere retained for each prior account end budgeted data by financial period. Thus, changes will involve shuffling lots of data.

File Setup

After the content and presentation of the financial reports has been determined, preparetion and input of master file data can proceed. To eid in this process, the eccompanying documentation devotes e good deal of spece to file setup. I recommend that you read it several times before attempting the setup procedure. As with the accounts receiveble system, an error in selecting an option in the initial files can cause a problem later on. The system uses decisions made when setting up the initial files to guide the setup procedure on the account and report files. For example, if a negative answer is made to the G/L cost center question on the company file maintenance screen, departmental reporting is inhibited and only a four digit account number is permitted.

Written in Cabal

The system is written in Cobol and like the other Cobol systems does not have full cursor controlled data entry screens. If an error is noticed in e data line after Enter has been pressed, the entire screen must be completed before corrections can be made. This feature and the strenge assignment of special function keys will take some time to become familiar with. the Tab, ESC and F1 and F2 are used as special function keys. Tab is used to end a progrem end ESC is used to restart data entry in a fleld. F1 and F2 may have different functions depending on the program in use. Unfortunately not all of the screens indicate the operation of these special keys so you just have to remember what does whet and when. While this is inconvenient, the other benefits of the system far outwelch this difficulty and all of the other three disk systems use the same conventions.

Report Generator

The key factor that distinguishes this system from all others that I have seen is the report generator. The report generator eccommodates five types of statement formats and allows a great deal of customization. The reporting format types include the balance sheet, profit and loss statement, cash flow, statement of changes in finencial position and analysis of changes in working capital. The different format types limit the column headings and retio analysis options available but otherwise allow freedom over account combinetions and presentations.

The means of implementing each format is found in the financial statement

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layout procedures. The layout is accomplished by creating a data file with a description of the form. To provide instructions to the printing program a special syntax is employed. The instructions are arranged in sequential order and are executed in the same manner as a Basic program. Although the report specification procedures are complicated, the sample report specifications included in the sample data files can be referenced as a guide. By comparing these specifications with the printed reports the use of each type of report syntax will become clear.

In concept and implementation, the report preparation procedures are similar to commercial general ledger systems. Vendors of these systems, which usually cost many times more than the Radio Shack system, train customers in use of report generators in special classes. Typically class time ranges from a week to several days.

Running the sample forms will give you some idea of the report preparation potential of this system. Nine sample formats are provided ranging from a balance sheet to profit and loss reports. These formats can be combined with the data in a variety of ways. For example, a balance sheet can be prepared with and without comparative information. The comparative data can either be a budget or the prior year's end of month balances. The same format can be used for either type of comparative data. As a result more than nine output reports can be generated with the nine formats.

When printing these reports the system allows printing in any sequence desired. The sequence must be previously defined. This has an Important advantage. If a summary set of reports and supporting schedules is required, then the whole set can be printed before any other printing is scheduled. Since the distribution of summary and detailed reports is usually quite different, this method of setting up a printing "job command language" for sequencing printed reports will be most appreciated.

Be prepered for a slow printing process. During the program evaluation process it took almost half an hour to print tweive reports with the limited sample data. While the computer is essembling the data, it appears to go to sleep. The screen indicates that processing is occurring and occasionally the drives are accessed but not much else is visible. The actual printing is also quite slow. The computer must do a great deel of processing since there is a rather long pause between lines.

However, the resulting reports are worth the wait. They reflect many thoughtful features which will be appreciated by the professional user. Account numbers are not printed. Dollar signs are inserted and foot notes are printed. A useful feature is the elimination of minus signs. In many reporting systems credits are identified by a minus or "cr" sign. In this system, if the balance is normally a credit or debit it is printed without a sign. If the balance is reversed, then the amount is printed with a parenthesis around it. This treatment conforms to normal practice for manual systems.

The system provides for the inclusion of text files. In the sample data only one text tile is included—a disclaimer; however, up to 99 different tiles each with a maximum of 23 lines of textual data can be accommodated. This feature is ideal for an opinlon, tootnotes, segment reports and any other type of detail which must be appended to professionally prepared financial statements. Once a text file is created It is printed as specified by the statement layout description. There is no reason why text file two cannot be printed before text file one. This will be a big help to those who cannot decide the order of footnotes until the lest possible moment.

Of course the source of all financial data for the reports is contained in the account files of the system. If departmental reporting is to be used these files will be quite extensive. When building the files, every bit of historical and budget informetion that will be required on the finencial reports must be entered. This will be quite e considerable undertaking. There is a provision to enter budget and prior year month end balances for thirteen periods. Once all balances are entered, the final amount for the prior year's activity can be established as the opening belance for the current year's activity. This is done by running e special program appropriately called Setup.

Monthly activity is obteined from three sources: standard journal entries, general journal entries and other three-disk systems. The standard journal entries or recurring entries ere sub-divided into two types, permenent and variable. Permanent entries are elways the same amount and veriable entries change each month. These entries, once defined, can be posted each month at the will of the system operator. If required, an automatic reversal entry can be specified. It that is done, the system will automatically generate the required reversing entries at the beginning of the next fiscal period.

Data entry from other three-disk integrated systems is accomplished by use of a transfer disk. Amounts to be transferred are extracted by a special interface program which offers the option of a transfer of deteils or the summary data for each account affected. We did not examine the transfer system during the evaluation process

Dete Entry

If the superior financial reports represent the good news, data entry can be considered the bad news. If data is to be entered through the general journal subsystem be prepared for slow data entry. Once the account number is entered, a two step procedure, the transaction date, amount, source, reference and reversal code must be entered. To reduce data entry time the system provides as default values prior data entered for the date, source and reference fields.

Obviously data for the system is best obtained through transfer from the other three disk systems. This condition should be easy to satisfy in a commercial environment where the other systems will be installed. However, in an environment where the accountant "writes up the books" on a monthly or annual basis a quicker method of data entry should be developed.

The slow speed of data entry is matched by the slow transfers from program to program. When a new option is selected on a menu, a caption appears on the screen—"Please Wait." After disk access, the selected program appears on the screen. If en error is made, a slow return to the main menu occurs end a slow selection of the new program is required. An examination of the disk directory provides a clue to this ponderous behavior. The system is segmented into many small programs which obviously take time to get in place to execute system functions.

This system, like the accounts receivable system, cries for a hard disk. If disk access times were quicker the system would be much more responsive. I suspect that when this system is installed in a more congenial environment than the floppy system it will behave with more alacrity. The floppy system also limits system capacity. In this system drive one is devoted to the five most frequently accessed files in the system. Only drive two is eveilable for transaction data.

To increase the storage room available for transactions, it is possible to "compress" data already on file. To understend the process, consider that an account like wages could contain daily information from a veriety of sources, weekly information and monthly information. Until instructed to "compress" the data, the system will retain all detail. The system offers the option of compressing data by date or

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by period. If compression by date is selected, all activity for a day will be consolidated. Debits will be offset egainst credits and the net result reflected in the account. If the debits end credits offset, no entry will be reflected in the account. If compression is by period, only the net activity for the period will be reflected in the account.

Compression

Compression should be used with care. Once data is compressed a cross reference back to the original journal entry will be impossible. Probably a good method for retaining data for cross reference purposes will be to retain a backup prior to the compression procedure. Then, should a question occur, the cross reference run can be performed on the backup disk to locate the problem.

Documentation

Documentation for this system is pro-

vided in a large binder similar to the Accounts Receivable system. Index tebs divide each section. These tebs make using the documentation considerably eaeler then other Radio Shack offerings. Unfortunately the tabs have only paragreph numbers rather than descriptive names. This made referral to the index mandetory before a section could be selected. Hopefully thie will be corrected in future releases. I found the documentation complete and informative. It included e section on general ledger concepts and contained two appendices on data files and handling Inventory. With the documentetion in hand, I found no difficulty in using the system.

in eummery, if the account end trensaction capacity do not disqualify this system, this package should be ideal for a prectitioner with write up work. If the client can be induced to use the Model II for accounts peyable and billing, dete entry

should be minimized. The General Ledger report generator will provide all of the required reports. Even if month end activity posted in the general journal is the sole source of data, the system will be useful. After all the financial reports are the professional's product and this system makes report preparation easy.

For the non-professional, the ability of the system to generate complex financial reports will be less important. However, because the system can generate departmental reports with comparatives and budgets, much valuable management information can be presented. In addition, the ability of the system to retain up to 4300 detailed transactions will be quite useful in tracking financial irregularities which could appear on the detailed reports.

This is indeed "big" system software at a micro price. I look forward to the next module in the "three disk" Cobol series. ■

80 REMARKS

Continues from page 8

our station is listening for any queries. When some amateur station comes on frequency and sends, say, an "M?" our station would autometically respond with a menu of the eveileble bulletin board materials. The other station would then choose one item from the list and request it... "7." Our station would then supply the number seven item, which might be the latest in DX news, complete with a list of the stations active from rare countries, their frequencies, where to send confirmations of the contact, and so on.

Or we might send out a list of the letest FCC dockets affecting amateur redio or other recent FCC news. We could heve a list of the traffic networks for handling messages, the recent repeater station changes, lists of other special interest nets, their times and frequencies, propagation predictions, a list of scheduled hamfests end conventions, new awards, and so on. There is a long list of information that hams might went to get and it would be available for the esking.

The plan will start out with 300 baud transmission, but soon revert to 1200 baud. We're going to encourage the experimentation with 9600 baud transmissions, since thet would ellow the transfer of information at eround 7300 words per minute. At that speed we might be able to get most messages in between the dots of jamming CW stations!

The next step would be to develop

automatic message relaying stetions so that ham messeges could be sent enywhere in the country in seconds. Imagine being able to drop a message to someone asking for a schedule in e few minutes on twenty meters! Where this would really come into its own would be during emergencies, when ell the emergency traffic could be sent via autometed means. Thus e hem could merely type the message on e smell computer system, like the Redio Sheck Pocket Computer, and it would be transferred to e central stetion for relaying to the eddressee-much as Federal Express flies all packages to one city for sorting and reshipping the next day.

Emergency nets would then be set up with the control station polling each station in the net every few seconds, looking for messages. When the stetion had one, the polling would trigger sending the message. In this way no two stations would be transmitting at the same time. The message received, polling would continue.

We will need to develop error-correcting systems so that all messages are received perfectly. 80 is open for any ideas or articles elong this line.

The Third World

A recent visit to the small Ceribbean island of St. Lucla brought home to me the need for some sort of education for deserving people from the smeller countries of the world. The U.S. used to have the Point Four program, but that is long

gone. Today, most of these students either have to make do with a poor education at home or else go to Russia or Cuba, where they are taught more politics than college.

Could we develop our proposed microcomputer school to the size where it could handle students from a hundred small countries? How would this be financed? Our government is trying to do all it can to stop spending, so they really don't need a new way to invest, even though it would be about the least expensive Investment they could make, in the long run. These students are willing to work hard, not only at school, but also at part time work to get an education. I'll be visiting some more small countries in the next couple of weeks and will see what I can find in the way of anewers to this problem. I'll be stopping off in Rlo to set up plans for a South American edition of Microcomputing, Then Sherry and I will be off to South Africa to attend a microcomputer exposition in Johannesberg, where I'm a speaker. We'll be visiting Swaziland and Lesotho, two very small nearby countries, where ham licenses and stations for me to operate have been arrenged. I'll be talking with the local hams and looking for Ideas for practical ways to get Third World students the education they need. Indeed, their countries have a desperate need for skilled electronics and communications people.

Meanwhile, I will be dreaming about a college cempus in New Hampshire, with modern buildings, heated mostly by solar heat, and surrounded by a couple hundred entrepreneurs and their growing electronics end computer businesses. ■



"You can try to design algorithms to emulate human behavior, or you can try to explain human behavior in terms of machines."

At SI, Machines Imitate Humans

The phrese 'artificial intelligence' summone up science fiction images of super-giant mainframe computers achieving sentience by sheer power and leading a revolt of the Moon colony against the government of Earth.

The truth is actually much stranger. At the Artificial Intelligence Laboratory et SI International (formerly Stanford Research Institute), Stenford, CA, one of the world leaders in this research, no huge light-blinking machine is achieving sentience. Rather, researchers use Digital Equipment Co. (DEC) PDP-10 computers programmed in Lisp to model aspects of human behavior.

Chuck Untulie, assistant director of SI International, stated that the PDP series

is the standard machine in artificial intelligence research because it is designed for interective work. "The IBMs are all batch process," he explained, "and the super-giants are just big scientific number crunchers."

SI approaches artificial intelligence from the computational or computer side. "You can try to design eigorithms to emulate human behavior, or you can try to explein human behavior in terms of machines. We take a look at the wey people behave in the world and try to emulate that behavior."

Although they do this entirely with software, they would like to have some specialized hardware.

"We keep talking to enyone who will listen about what we went in hardware," he stated. "Unfortunately, we're a pretty small organization, and none of the big companies listen, so we end up buying from the small firms."

Students Learn Psychology From Artificial Intelligence

hile most people are interested in Artificial Intelligence for its practical applications in the computer field, at least one other use has been found. Or. Homer "Tony" Stavely, a psychology professor at Keene State College in Keene, NH, is teaching a course using Al as a tool to illustrate some principles of psychology.

"Computers and Thought," as it is titled, will emphasize the "use of computers to simulate psychological processes," according to the course catalog. The course will also review early Al research as well as theory. Students will discuss the current state of the art and the possible future of Al. Textbooks will include Artificial Intelligence by Patrick Henry Winston and Machines Who Think by Pamela McCorduk.

Stavely, who has had an active interest in computers for several years, believes that there is a similarity between the thinking process of a computer. Though he concedes there are some obvious great differences, he said, "In the fundamentals of information processing, it doesn't matter if it is a machine or an organism... (there are) probably similar principles."

Stavely makes a convincing argument for using AI in teaching psychology. "The study of psychology is the behavioral relationship between organisms and their environment," he said. This "transactional re-

lationship" produces behavior guided by the intake of information. "Al attempts to program machines to process information in ways which approximate the sophistication of (human) information processing," Stavely said.

There are three goals that Stavely has set up for his students to achieve. He wants to increase their understanding of the nature of perception and thought; to demonstrate that computers are tools to aid in their thinking; and to show that computers are inportant as a simulation device. This last goal emphasizes the use of a computer to set up a hypothetical situation to "see what happens it..."

Stavely sees Al programming giving computers some ability to perceive problems, organize and remember information and, ultimately, write programs on their own to control their databases.

The future of AI is promising, Stavely believes, especially in the educational field. He seld that hardware capabilities far outstrip the capabilities of the software that has been produced. He thinks that AI may be the answer to this software problem. "AI is the area in which we are learning the software skills to bring about advances in using computers as tools to think with," he said.

by Michael Nedeau 80 Microcomputing staff

Hard to Dafina

Untulis sees artificial intelligence research as going in several directions, but finds it very hard to define goals or even talk about the research because the concepts are so new the language has not adapted to it yet.

"We really don't know what artificial intelligence is, so there's no way we can define what our goal is. In the more traditional areas of science you cen define your goal, and you know the methods you will use because they are all established. We work with concepts nobody has used before, and we're not sure how to talk about them, much less how to define our goals."

Many labs are heavily researching distributed intelligence. This concept postulates a lerge number of intelligent machines in independent operation in various parte of the world. Because of distance, different design and different use, they would have different information. One machine might heve more upto-date knowledge on a given subject than another.



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If, then, one machine asks another a question and receives data back in answer, how does the first machine handle the data it receives?

"You get into the whole question of belief structures. Each machine has a belief of what the world is, and that belief might be inaccurate." The question is how these belief structures are modeled, limited and changed.

Expert Systems

Another area of artificial intelligence is rule, or expert, systems, in which researchers preserve and communicate to others the special understanding of an expert (an Einstein, for instance).

The hope is to capture the expert's world view in a finite number of data statements to quantify it. "You do that with a set of rules which set up a model which can be given data or esked questions."

Another area involves designing programs that will handle normal language, either in the form of keyboard input or, turther down the road, verbel input. The goal is to eliminate the need for programming languages to communicate with the computer. The businessman could talk with his machine just as he can with a human employee; if he needs to know how many widgets he has in St. Louis, all he has to do is ask. The computer will decide what data bank to query and exactly what piece of information is wanted.

Vision Input

Vision research is another area in which SI International is active. Humans have a very high talent for interpreting visual data; It is difficult to approximate that ability with a machine. SI is developing programs which allow the computer to digitalize a picture and not only understand the literal data but draw conclusions from clues.

For instance, they would like the machine to locate a hidden light source from such clues as the size and placement of shadows. It then should be able to describe the expected reflectivity of objects from the inferred position of the light source.

One goal of artificial research is the self-programming computer, the machine which can decide for itself how to go about doing something and change its ideas on the basis of experience. According to Untulis, SI is working on the theoretical and of this question by designing theorem-provers. These are methods whereby a machine, given an idea or theory, can experiment to determine whether the theory is correct. If it is not, the machine will modify it to fit the

experimental data, much as a scientist works in a lab.

A Question of Difference

All of this involves one of the basic questions of artificial intelligence: Is it qualitatively different from human intelligence or does it only appear to be different at this stage because it is so primitive?

Computers are famous for their ability to instantly memorize and manipulate huge lists of items. Humans cannot do this neerly as quickly or as well. Yet, machines cannot make decisions on their own—humans have to tell them precisely what should be done with their data.

The answer, Untulis explained, "depends on whether you are talking on the short run or the long run. If you are talking on the short run, then it is both qualitatively and quantitatively different. If you are talking about the long run, then it is not." However, the long run probably means anywhere from 200 to 1,000 years.

Researchers are presently working with limited domains, try to construct algorithms that emulate human behavior, while dealing with general problems in a theoretical manner.

So why is this in a magazine on microcomputers? What relevance does it have for the TRS-80 user?

Cognitiva Science

The research into artificial intelligence falls under cognitive science, a new branch of science that includes aspects of both computer science and psychology. The fallout from the research in this area is likely to influence the design of the machines we will be using as well as our concepts of ourselves in the 1990s end beyond.

Untulis mentioned he sees a couple of areas in which artificial intelligence research may soon be influencing soft-

ware design, although he cautioned that the issues are far from clear.

One area in which machines can do a better job than humans is very large-scale integration in, for instance, circuit design. One company is trying to adapt planning and deduction methods worked out at Si international for multiple-level planning to this sort of operation.

In multiple-level planning the machine works on an abstraction ladder. It starts at the top, forming a very generalized plan, or, in this case, circuit design concept. It then moves down a step and makes a more particularized design concept based on its generalized work. In this way it works from step to step towards the actual design of the circuit.

"The hope is to capture the expert's world view in a finite number of data statements..."

If its tests show that the most recent plan is faulty, it moves back up the ladder to more generalized plans and refines its steps.

Visual interpretation would also be very handy for a machine that designs or tests circuits using this multiple planning method.

"All these things go hand-in-hand," Untulis told us. "We want the machine to keep track of the errors we make in designing one circuit, for instance, so it will be able to warn us if we start to repeat them in the next circuit design."

These ideas may be used in the future but they will not be here tomorrow.

"The things we're talking about are 10 to 20 years from fruition. We're just thinking about these things today."

Radio Shack, Ohio Publisher Plan Joint School Market Assault

andy/Radio Shack, Fort Worth, TX, and South-Western Publishing Co., Cincinnati, OH, a leading business education and business administration publisher, will work together to develop and market educational courseware for TRS-80 microcomputers.

According to William D. Gattis, director of Radlo Shack's Education Division, South-Western will help Tandy in the development and marketing of programs for Models I and III, and Radio Shack,

in return, will provide computers for demonstrations and displays by South-Western at major educational shows and conventions.

Radio Shack will also develop special software protection features for the Model I similar to those already available for the Model III, to prevent unauthorized copying of South-Western's software.

South-Western is a subsidiary of SFN, Chicago, IL, a large elementary and high school education publisher.

■

Microcomputers Enter Medicine

computers have been used by the #medical community for nearly two decades. In May of 1980, Modern Healthcare reported that community hospitals spant more than 1,25 billion dollars a year on computarized business and madical information systams. The Journal Of The American Medical Association found, in its report on "Computers in Madicina" (Dec. 1978), that computers were being used routinaly in hospital laboratories, radiology departments, amergancy rooms and pharmacies. Not only wera computers maintaining patiant charts and billing racords, they were also capabla of such high laval tasks as predicting the probability of gangrene infections in appendicitis victims.

Since their widespread introduction four years ago, microcomputers have also begun to have an impact on the practica of madicina. The vest majority of physicians who use microcomputers are primarily interested in office management, but according to Gene Thompson of Thompson Consultants, Seattle, WA, "Thirty percent of the doctors who have been exposed to microcomputers are learning to program."

This is because doctors appreciate the potential of the microcomputer and realize they themselves "will create the applications—once they learn to program," says Thompson.

Hospitals are using microcomputers in increasing numbers to handla spacialized tasks. Many such tasks could be performed on hospital mainframe computers but this creates a number of problems—timesharing limits accassibility, new software is extremely costly for mainframe computers and satup procedures are costly. With a microcomputer in the lab to calculate blood gases or in the pharmacy to assist in the preparation of prescriptions, hospitals can greatly improve efficiency without a large financial invastment.

"One hospital I know of uses a microcomputer to calculate hormone balances, others are using them to do small office tasks, and one pathologist uses a text editing program and a micro to keep notes on patients," said Thompson. "Micros are aspecially useful for recording and tabulating laboratory protocols, which ere the results of visual tasts and inspections in fields like bacteriology and microbiology." Thompson speculates that microcomputer use in medicine will continue to grow and

that software axchanga among physicians will become a common practica.

There is a precedent for this kind of software exchange. Robert Kinch of the Forsyth Memorial Hospital in Winston-Salem, NC, is the President of ECHO, an IBM usars group whosa members are hospitals and doctors. This group exchanges software across the entire spectrum of medical related applications, including ambulatory care, clinical managament, cansus managament and laboratory/pharmacy use. Thera is a similar group for microcomputer usars as wall as saveral medically-oriented try. Thasa bulletin boards will likaly play a kay rola in the development of physician's key role in the development of physicians user's groups.

Commercially produced softwara is also aveilable. Radio Shack salis a Medical Offica System package for use with the TRS-80 Models I and III. Dr. Larry Stoneburner runs MadLogic Systems, a Los Angales, CA, firm selling software for both administrative and medical applications.

Thompson, however, thinks most doctors are "skeptical about prepackaged software." Hance, many physicians are becoming programmers.

One example of the way a microcomputer can make a hospital more afficient is the General Hospital in Ventura, Celif. As reported in *The Journal Of Family Practice* (Vol. 11, No. 4), the hospital's resident doctors were tying up phone lines to the outpetient clinic with constant chacks to see if their petients had errived, when their next appointment was scheduled and the like. With 35 physicians using the clinic, the load became hard to manage. The solution proved to be a microcomputer.

The hospital had a closed-circuit talavision systam already in place. It was a simple matter to patch the microcomputer into that closed circuit system. The outpatient schedule could then be entered into the computer by a sacretary and displayed throughout the hospital on a regular basis. The software was designed to permit not only a display of the clinic's schedule, but also to indicate whether a patient had arrived for his scheduled appointment.

The physicians were able to conduct their rounds in the hospital while periodically consulting the televised outpetient schedule to find out when they needed to be in the clinic to see a patient. This system cut down on the volume of doctor's telephone calls to the clinic by 40 percent in the first four weeks of operation. The physicians involved overwhelmingly approved of the system.

Still, while microcomputers are catching on with the medical community, some doctors and administrators harbor reservations about system capability. The Canadian Medical Association's Exacutive Secretary, writing in the March 22, 1980 issue of the CMA Journal, stated flatly that microcomputers were too small and too unreliable for use in medical practice. B. E. Freemo cautioned physicians to weit to see it good software was developed and to demand that hardware vendors provide service contracts as a condition of sale.

In spite of thase kinds of cautions and what Gane Thompson calls the "Innate conservatism of physicians," don't be surprised if you sae a TRS-80 in your doctor's office somatime in the near future.

by G. Michael Vose 80 Microcomputing Staff

Medical Journals Cover Computers

a if doctors didn't already have anough literature to keep up with, there are now several publications circulating information about clinical uses of microcomputers. There is a nation-wide, general purpose publication called National Report: Computers And Health; there are general information exchange newsletters such as Dr. Com Puter's Report and the Apple Mug Newsletter; and various specialty newsletters for dentists and psychologists.

Most of these publications are concarned with one thing-finding out who's doing what and how to contect them. The name of the game is information exchange. There is appearably no greater consumer of information than medical doctors.

in February Dr. Larry Stoneburnar of Oranga, CA stertad a newslattar as a mathod of information axchange among the Apple Medical Usar's Group. Called the Apple Mug Newsletter, the publication has grown from five subscribers to its present 400, in just five months. Apple Mug is a member of the international Apple Core, an international organiza-

80 NEWS

tion of Apple Computer Clubs.

The Apple Mug Newsletter features news about doctors using computers in their practice, particularly clinical applications. It is a forum for the exchange of ideas among its members. Although the Apple Mug is primarily composed of Apple computer uses, the Newsletter is interested in developing a rapport with CP/M users in order to obtain a broad base of software techniques, ideas and applications.

The Apple Mug Newsletter has plans to present a Medical Applications Seminar at the West Coast Computer Faire in San Francisco next March, and is currently soliciting papers for presentation during this seminar.

On the east coast, there are two medical microcomputer publications coming from the same office. The Medical Computer Journal and Dr. Com Puter's Report are published quarterly by Dr. Azis Ghaussy of East Hampton, CT. Dr. Ghaussy's journals not only provide a torum for the exchange of news and ideas—they also publish medical ap-

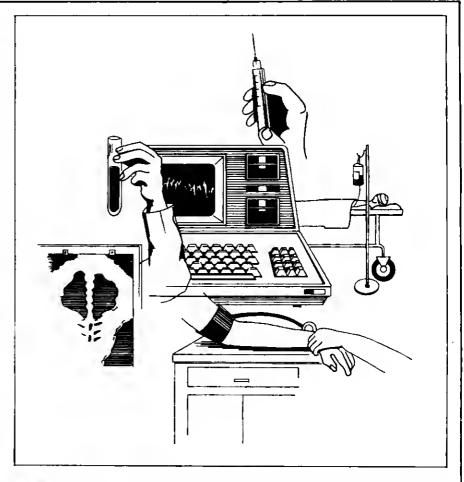
Dr. Ghaussy's journals not only provide a forum for the exchange of news and ideas—they also publish medical application program listings.

plication program listings. With well over 1000 subscribers, including 75–100 international subscribers, the Journal and the Report reach a wide variety of physicians using microcomputers. Both publications print software listings for Apple, TRS-80 and North Star Horizon computers.

The Journal and the Report seidom pay for submissions; physicians share software in an affort to help their patients by keeping the information exchange dynamic.

The publications mentioned in this article may be contacted at the following addresses: National Report: Computers and Health, PO Box 40838, Weshington, DC 20016; Apple Mug Newsletter, 2914 Katelle Suite 208, Orange, CA 92667; Medical Computer Journal and Dr. Com Puter's Report, Dr. Aziz Ghaussy, 42 East High Street, East Hampton, CT 06424.

by G. Michael Vose 80 Microcomputing staff



Medical Software Exchange Helps Docs Sell Programs

As physicians begin to develop an appreciation for the potential of the microcomputer, they apply their medical knowledge to the task of producing software with medical applications. Many physicians try to market the result of their labors but find it extremely difficult to track down other computer doctors. Enter SoftDoc, a microcomputer software exchange.

SoftDoc Is the creation of Dr. James Gange of Los Angeles, CA. Dr. Gange began SoftDoc as a way to help some like-minded physician friends who all had some software they were willing and eager to shere with their colleagues. Since its inception about a year ago, SoftDoc has been adopted as an official project by the Society for Computer Medicine, whose President is Dr. Marion Bell, the Director of Computer Services at the Temple University Medical School.

SoftDoc's current offering is a CP/M based collection of approximately 25

programs. Included in the package, distributed on en 8-inch floppy disk, are programs to:

- · evaluate pulmonary function;
- · set up a respirator;
- generate evaluations of lab tests such as glucose tolerance and electrolyte balance;
- evaluate a patient's lifestyle, help the patient figure out why he cannot give up smoking, and suggest ways to improve health by changing lifestyle habits:
- the ANSI standard Mumps program, the most commonly used medical usage lenguage.

All these programs are written in various dialects of Basic (with the exception of Mumps). The disk is available to physicians for a price, or a physician can join SoftDoc and receive the software free by contributing software to the exchange.

The program will run, with some

modification, on the TRS-80 Model II under the CP/M operating system.

SoftDoc is always on the lookout for new software and is looking for competent software editors and programmers, as well. Dr. Gange says the exchange cannot pay editors at present but can arrange to provide references in return for editing, translating to other Besics and operating systems and debugging. Soft-Doc is not interested in business office software; the thrust of SoftDoc is clinical application software.

In a recent Interview with 80 Microcomputing, Dr. Gange said that, theoretically, microcomputers should have a profound impact on the practice of medicine. Practically, however, he said, "this hasn't happened yet. The development of clinical applications is still in the embryonic stage."

Dr. Gange speculated that growth in the field had been slowed by the difficulty of distributing medical software. This was one of the reasons he has launched SoltDoc.■

For further information, write to:

SoftDoc cio Dr. James Gange 1433 Roszmare Road Los Angeles, CA 90024

> by G. Michael Vose 80 Microcomputing staff

Computer Aids Help Handicapped

Computer aids now make if easier for the handicapped to work, communicate with others and seek emergency help. They assist the hearing and visually impaired as well as those severely handicapped from cerebral palsy or spinal disorders.

The most widely used device is the TTY/TTD (teletypewriter telecommunications device), which allows the deaf to communicate over telephone lines. The National Crisis Center for the Deaf has a 24-hour hotline that receives TTY/TTD communication concerning medical and emotional problems and dispatches emergency help to callers. "They receive 10 to 15 calls a week," says director Mary Compton.

A prototype conversion of the TTD baudot to ASCII code has been developed by Paul Rinaido of the Amateur Radio Research and Development Corporation (AMRAD), using the TRS-80 Model I. Rinaido has also made prototypes using the Commodore PET and Apple computers. This would allow these machines to replace the teletype terminals as home communication devices.

Two states offer TTD/TTYs at low or no cost. Michigan Bell now setls the device after a Public Act mandated they be made available at cost of production. Since March 1981 they have installed 800 TTDs.

in California, phone companies are required to supply the devices at no cost; they have until 1984 to comply with the legislation. An original bill required TTDs be available at \$14.50 a month, and they were installed in the pilot program in Fremont, CA.

Microprocessor

Most TTDs feature a single chip microprocessor that converts baudot to ASCII. Printer and display are either separate or one unit.

A number of companies are producing the TTDs, including Plantronics Inc,

whose VuPhone has both baudot and ASCII; Applied Communications Corporation, whose Phonetype was the first TTD developed; Specialized Systems Incorporated, whose customers include Sears Roebuck, Bank of America and 32 state governments; and Krown Research, whose Porta Printer Plus offers ASCII code format for \$100 over the \$575 price tag. Various teletypewriters are also available.

Automated Data Systems of Madison, WI, produces an alternative to the TTDs called Superphone, a terminal with voice synthesis that cen be used with any touchtone phone. It allows direct contact that the TTY doesn't, since the receiver of the call doesn't need a TTY terminal. The Superphone terminal also can be attached to a television set to produce a CRT acreen and has features euch as an automatic answering device.

For face-to-face communication, the deaf and dumb can use Automated Deta's VIP communicator, a pocketelzed teletype with an attachment worn on the person's lapel flashing the letters being typed.

For the Blind

Terminals are also being modified for the blind. A Low Vision Terminal (LVTS) prototype has been developed by M. Daniel Simkovitz, an angineer at Wayne State University in Detroit. The screen ahows characters three inches high and allows the partially sighted to read serially or a few characters at a time.

"The partially sighted are not understood," says Simkovitz.

Most work has gone into synthetic voice for talking computers or braille keys with a voice output. But 80 percent of the 347,000 legally blind still have some vision, and many of those could use the LVTS, he says.

There are also printers available for the partially sighted. Automated Data offers printers and CRTs with large characters and a computer with braille

printer output.

Voice synthesizers use either electronic phoneme synthesis or the more subtle ellophone synthesis. Most micros, including the TRS-80, have single chip voice synthesizers available.

But not all computer commands can be represented by speech, Simkovitz says, which makes the LVTS more valuable to the partially sighted. Besides, the partially sighted often don't read braille.

Interfaces are being produced that allow the severely handicapped to operate a keyboard. The Express I & II from Prentke Romich Company, Shreve, OH, are key interfaces with serial ASCII data that converts to parallel ASCII. The interface features a panel of 120 blinking lights. A joystick or optical head pointer is used in place of the keyboard. When the user makes the selection by an optical head set, a microprocessor receives the signals via a small tube with a lens and light sensor.

These devices should help the nation's 21 million disabled in their homes and jobs. Those developing computer aids hope to increase job opportunities for the handicapped.

Superphone "could make a difference, especially when employing the deaf," says Rob Engelke of Automated Data. "Even a stock clerk . . . has got to be able to contact people."

Electronic Silly Putty

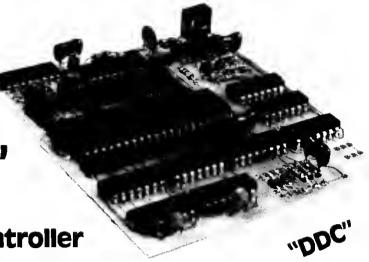
A writer in the Midwest is using the Express I with printer hookup to produce a monthly column. Engelke says he's had some orders from businesses, and computer companies are snapping up his terminals because they can be modified for other applications.

"It has a bus, it's just like an Apple," he says. "There's plenty of room in there. It's electronic silly putty in a keyboard."

Institutions have also been buying products for the handicapped. Now thet

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The test consisted of formatting 40 tracks on the diskette and writing a 6DB6 data pattern on all tracks. The 6DB6 pattern was chosen because it is recommended as a "worst case" test by manufacturers of drives and diskettes. An attempt was then made to read each sector on the disk once - no retrys. Operating system was Newdos/80, Version 1.0, with Double Zap, Version 2.0. Unreadable sectors were totalled and recorded. The test was run ten times with each double density controller and the data averaged. Test results are shown in the table.

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LNW "LNDOUBLER"	202		

Note: test results available upon written request. All tests conducted prior to 8-25-81

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80 NEWS

Michigen Bell hes made the TTD avalleble, severel offices and stores have purchased the equipment for employees.

"The cutting edge for this type of device is employment," seys Simkovitz of his LVTS. Many partially sighted people "have steered awey from some professions because of obstacles they fece with computer devices."

Simkovitz, who is himself legally blind, seys "For many years I feced frustration with computers." He's hopeful others will develop further applications of the

There is a program currently placing handicapped people in the job market. National Quest, a part of Unicos Corporation, Leominster, MA, will train the handicapped in computer-related fields and place them in industry. Integral to the program is the talking computer Unicos has developed that reeds back input and output to the blind. The handlcapped could also work at home, sending reports to their employers through a modem.

Interest in computers for the handicapped is growing, and Johns Hopkins University hopes to harness some of this

enthusiasm with a Personel Computing to Aid the Hendicepped contest, sponsored jointly with the National Science Foundation and Radio Sheck. Entries will be judged in three categorles: computer-besed devices, computer pro-

"For face-to-face communication, the deaf and dumb can use ...a pocket-sized teletype with an attachment worn on the person's lapel flashing the letters being typed."

grems or system concept/design. The entries will be displayed in ten regional feirs with a final exhibit from Oct. 31 to Nov. 1 at the National Academy of Sciences, Washington, DC. Johns Hopkins will eventually have a two-day workshop to unite the winning inventors. They've received over 800 entries so far.

Market Problems

Though Interest in computers is high, it's sometimes hard for inventors to find companies to market their products. Paul Rinaldo is still trying to find someone to market his ASCII prototypes for the TRS-80, Apple end PET. It's particulerly hard to find a distributor for the TRS-80, since the Model I is out of existence. Creating a Model II or III prototype "would mean starting all over again," he says. The Model I prototype took two years to develop.

Now Rinaldo is planning en \$100 interface end prototypes for the TI end Atari computers. He's received federal grants of \$46,000 end \$50,000 in the past two

Simkovitz's project was underwritten by the university "way beyond their initial commitment," he says. But budget cuts made further funding impossible, and he needs \$30-50,000 to complete the LVTS so It's ready to market.

Support from the outside has been "shameful and shabby," he says. He's

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Summersville, MO 65571 *RADIO SHACK is a trademark of Radio Shack, a Tandy Corp. talked to several companies, and half a dozen have seen the prototype, but he's hed no offers yet. Simkovitz would like to teke the product to a small company experienced with products for the partially sighted.

Costs

The cost of computer aide may be steep for the user as well. The LVTS should retail for between \$2500 and \$4500. The Express I intertace is \$2380; the Express II, with full ASCII cherecter set but no printer, is \$1900. Prentke Romich's environmental control units, which hook up to electrical appliances in the home, run from \$560 to \$1325. The hand-held teletype VIP communicator is \$199 with an \$89 voice attachment. Autometed Data also offers a computer terminal for the blind with epeech output for \$900 to \$1000.

The TTDs, in states that don't provide them through the phone company, run about \$550. In Michigan, Bell Telephone provides a TTD for \$400.86, or \$6.68 a month for five years. You can lease the device for \$125. In California, users pey only for regular telephone service.

More affordeble are Information services including the bulletin board service SpecialNet and Creative Computing for the Handicapped, a West German organization.

Though SpecialNet is directed et speciel education administrators, its

"The cost of computer aids may be steep for the user as well."

bulletin boards will feature information useful to the handicapped. A litigation builetin board will be managed by the editors of the Education of the Handicapped Law Review; the Prentke Romich Compeny will operate a bullatin board on ayatem devices for the handicapped; and a federel bulletin board will contain pending legislation of importence to the

handicapped, including federal budget actions. SpecialNet will also feature electronic meil.

The Association for the Advancement of Microcomputer-Besed Work at Home for the Handicapped, West Germany, will translate articles on microcomputers onto cassette for the blind. They also will translate advertisements with information on how to order software and hardware from American distributors.

Prentke Romich may organize a review board made up of special education teachers and the handicapped who would evaluate educational software. Their initial network project, Apple Computer Clearinghouse for the Handicapped, has been scaled down, though they may compile a service catalog of software for the handicapped, says computer manager Nell Russel.

Computer companies are offering more services and products for the handicapped, and finding a market for them. All they have to do," says Engelke, is "use their imagination."■

> by Betty Thayer 80 Microcomputing staff

NEWDOS 2.1 — NEWDOS/80 users INTERACTIVE CONTROL LANGUAGE

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80 NEWS

Computeens Mob Camp Keep Prof Jumping, Happy

or the fourth year in a row, Dr. Michael Zabinski (of Fairfield University, New Haven, CT) and a group of experienced teachers spent two weeks this summer with more than 100 teenage computer nuts.

Taking place during the last two weeks of July in the Klar Crest Resort in Moodus, CT, the fourth annual National Computer Camp was a complete success, according to Dr. Zabinski. He told us more than 160 campers aged 10 to 18 of both sexes came and had a good time.

The camp, the first of its kind, combines small group instruction in microcomputer uses with strong emphasis on the TRS-80 with normal camp activities. Students this year came from as far away as London, England, and Caracas, Venezuela.

One hundred ten students attend the camp for a week, and about half of them stay for the second week. The staff includes 188 teachers plus two recreational organizers, two directors, a medical doctor who is doing computer research and Dr. Zabinski.

The students work in small groups arranged according to their level of knowledge, ranging from beginners to two groups of Assembly programmers. All work on TRS-80s, except one of the Assembly programmer groups which used Apples and a Wang minicomputer.

A typical camp day starts with a morning computer session from 9 to 11 a.m. There is a midday break for sports, including swimming and diving in the camp pool, and soccer with a college varsity player who is a physical education major. After lunch the students relax until 1:15 when they go back to the computers until 5 p.m. At night Dr. Zabinski runs a movie or other special event. One night they conducted a Las Vegas night, with games of chance run on the microcomputers.

Most of the computer work is done in a spacious and well-lit camp hall. The campers worked in an informel atmosphere, moving around a lot and sharing information and activities.

"This is not a classroom setting," Dr. Zabinski explained. "We give them books but they are not textbooks and we never tell them to turn to page such and such. We use them for reference only."

The campers are often too dedicated to their computer work. In spite of the beautiful, quiet grounds of the resort camp and the bright weather, Zabinski

had to personally order some of the kids out of the hall to take a swim at the 11 a.m. break.

Rick Larcom, a teacher from a New Canaan, CT, high school who runs the TRS-80 Assembly group, mentioned he has to turn out the lights at night to force the kids to leave and he has to lock the doors or he'll wake up to find some of them already at work early in the morning.

Dr. Zabinski feels that the secret to the success of his camp is the staff. "I handpick everybody. I train most of them myself. Most of my teaching assistants used to be campers. I emphasize that I have to have a good staff. They're knowledgeable and experienced at what they're doing."

The teachers come from all levels, from elementary through high school, and Dr. Zabinski tries to match the teachers with age groups they are used to. This isn't always easy or even possible—the groups are divided according to the students' level of accomplishment, not age, and especially in the upper levels the ages are fairly mixed.

The emphesis of the camp is not solely on learning hard technical material. In fact, Larcom teaches social studies, not math, during the year.

Zabinski isn't worried about technical orientation among his teachers so long as they know their subjects well end are good with the campers. His concern is having the students learn something.

His formula is proving very successful. "When the kids come back year after year and bring their friends, it tells you something about how well you're doing," explained Dr. Zabinski, who added the camp does practically no advertising because it fills up so fest from repeat campers and people who have heard of it by word of mouth.

Next year they are considering expanding to four weeks and may run one special week for computer campers with diabetes.

The camp medic, Dr. David Rowe, is a pediatrician from the University of Connecticut who works with diabetic children. His interest in diebetic children may spur the special week next summer.

Zabinski appreciates the complications this would involve, but he's confident they can handle just as they first handled the much greater problem of creating a computer camp.

French to Make Model III For Radio Shack Europe

andy/Radio Shack, Fort Worth, TX, has some good news for European fans of the TRS-80. The firm Is completing an agreement with a French electronics firm to manufacture the TRS-80 Model III in France.

Tandy spokeswoman Harriet Rylander said if things go well the French company, Matra SA, will have the microcomputers in production by March.

Tandy is making its French connection to improve the supply of TRS-80s in the Common Market countries. Tandy involvement in the Europeen microcomputer market does not approach the success it has had in the U.S., and Rylander blamed this on lack of supply.

Tandy's U.S. manufacturing facilities are straining to keep up with domestic demand, so TRS-80s have been rare in Europe. The Model III was not available there at all until June, and is still hard to find.

The French connection is the second foreign agreement Tandy has ennounced in the last few months. They earlier announced an agreement with Tokyo Electric to manufacture and jointly market the Model I in Japan.

Until this summer Tandy had made all its microcomputers in its own plants in the U.S. However, Rylander said the announcements do not so much represent a change of company tactics or policy as the exercising of an option Tandy always considers when supplying a new market. Having a local host simplifies many areas for Tandy.

Other Products

Matra SA is a large French conglomerate active in areas including telecommunications, space technology and mass transportation. According to Rylander, Tendy is interested in developing other connections with Matra, particularly in telecommunications, if the Model III deal works well.

The Matra deal has been approved in principal by the Franch government. However, arrangements between the two firms have not been finalized, and once the agreement is signed it must be approved in detail by the French government.

Tandy President John V. Roach stated, "This joint venture for computer manufacturing represents an important milestone in our growth in Europe in general and in France in particular. It will significantly strengthen our ability to support the European microcomputer

School Microcomputer Aid **Clipped by Budget Cutbacks**

Ithough a number of federal agen-Acies offer grants that could be used for projects involving microcomputers in the schools, many are receiving funding cutbacks or are being absorbed in the block grant program.

Title IV B and IV C of the Elementary and Secondary Education Act of 1965 authorized the largest sums for microcomputers. The Office of Libraries and Learning Resources, which administers IV B, granted 40 percent of last year's \$161,000,000 for projects involving microcomputers. Title IV C, whose funds are granted to improve local educational practice, doled out \$66 million in fiscal

With both funds going to block grants in fiscal 1982, 20 percent of the available money will be given to the states and 80 percent to local school districts, which means the schools themselves will have more control over how the money is spent.

Budget Jitters

Many grant agencies expect cuts in next year's budgets, however. Authorization hearings ere still underway in the House of Representatives, leaving the agencies up in the air about how much money will be allocated next year.

No federal agencies are authorized to fund projects solely for microcomputer purchase or use, but many will fund larger programs involving micros. These include:

 The Division of Adult Education: Part of the Office of Education, Adult Ed. recently dispersed \$100 million in grants to expand adult education skills. Money is given to the states who determine allocations to school districts. The program should remain a categorical grant

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for next year.

- Bureau of Education for the Handicapped, Division of Innovation and Development: The Education of the Handicapped Act euthorized money for research into improved education for the handicapped. Some applicants funded in the past already had microcomputers; grants have supported computer-administered testing and research, as well as curriculum development using micros. Max Mueller, chief of the research projects branch, says next year's budget could run anywhere from \$8-20 million.
- Office of Bilingual Education, Office of Education: This program is designed to improve teaching English as a second language, using the student's native language. The program funds micros as part of a basic bilingual program for elementary or secondary education. They awarded 525 grants last year and expect a budget of \$139,000,000 for fiscal year 1982.
- Fund for the Improvement of Post-Secondary Education: Robert Fullilove, director of the program, saye they have granted "substantial funding" for micros at colleges and universities. Grants have been awarded to San Francisco State College to establish a "meth anxiety clinic" with a Commodore PET computer, and to the University of California at Santa Barbara, where micros are used in elgebra classes. Fullilove estimates level funding for next year, which would be about \$13 million.
- Appalachian Regional Commission: Authorized by the Appalachian Redevelopment Act of 1965, this program provides grants to vocational schools and post-secondary technical schools. Director Melvin Rottenberg describes it as a "flexible block grant program" administered by the area states. Their maximum budget for 1982 should be \$50-65 million.
- The National Science Foundation: While the foundation has not awarded money for micros in elementary or secondary schools since 1970, it has awarded substantial grants to postsecondary schools for research involving computers. As part of the Local Course Improvement Program (LOCI), they gave \$2.49 million to 125 Institutions for research; another program awerded \$2.7 million in 1980 for the purchase of scientific equipment at 215 colleges. Grants included \$18,569 to the University of Hawaii to develop a software laboratory. and \$13,975 to SUNY College at Oswego for an on-line microcomputer laboratory for behavioral research. About half of the LOCI awards go to microcomputer projects, says John Maccini, who coor-

dinates the program:

• Teacher Center Program, Bureau of Higher and Continuing Education: Teacher Center grants establish inservice centers for educators; meny of these contain microcomputers. The program has a \$10 million budget for fiscal year 1982, and will be absorbed by the block grant program the year after. It originally funded the establishment of 60 teacher centers in 1978; half of these have retained funding. Many of the others are now supported locally.

No Funds Here

Programs that are being dissolved or which no longer fund micros include:

- Coastal Plains Regional Commission, a program assisting vocational schools in the southern coastal areas, is ending Sept. 30; it had received applications involving micros but none were approved by the states.
- Emergency School Aid Act of the Equal Educational Opportunity Program

cannot allocate its monles for micros, according to director Jesse Jordan. The agency was incorrectly included in a list of available funds collected by Beil & Howeli, Chicago.

Even if federal funds are limited in the 1980s, the agency officers doubt this will have a detrimental effect on micro development in schools.

"They are getting computers in the classroom by hook or by crook," says Bob Tinker of the Technical Education Resource Center (TERC). PTAs and districts are being called upon as well as formal state and federal funding sources.

Linda Roberts, a researcher for the Division of Educational Technology, agrees. "School officials are saying, 'Hey, I want a micro—and we're heving a cake sale to get it.' There's a real grass roots effort."

by Betty Theyer 80 Microcomputing staff

Students from 5 to 105 Enjoy Hands On Science

The Talcott Mountain Science Center for Student Involvement (TMSC) in Avon, CT, is an unusual learning institution. Dedicated to teaching science by getting students involved, it educates children from kindergerten through college level in private programs for Center mambers and by the class under contract to a variety of public and private schools and the University of Hartford in nearby West Hartford, CT. Computer programming is only one of the several hard science subjects the center offers.

While most schools take a classroom approach to science, with a heavy emphasis on lecture and theory and a limited amount of laboratory time, TMSC presents little or no lecture and puts the students into e hands-on situation under the guidence of teachers and scientists. TMSC students have been involved in genuine scientific research, helping staff members develop raw data for papers for international symposiums. The students, who range from age five to 22 end from upper middle class "rich klds" to inner city Hartford blacks and Chicanos, respond enthusiastically. Careful testing shows they also learn more quickly and thoroughly than students in traditional classrooms.

TMSC's Computer Science Department is fully integrated into the general activities of the Center. Housed in a new solar-heated building, the Center offers

students a variety of microcomputers which include all the Radio Shack products. Over the summer the heaviest users are members of the Center's Quest program. These are teenagers from grades 5 through 12 with high science aptitudes who work on projects of their own choosing for two week periods. They are divided into beginners, intermediate and advanced or Assembly language classes which work in three separate rooms in small group situations.

Practical Programs

An unusual aspect of the Center program is that it is self-reinforcing. Many of the students work on programs that they or others at the Center will use to learn about computers or augment other science projects. One student is developing a program which will accept weather data from radio weather reports and draw a weather map. When it is finished the program will be used by the Center in their meteorology courses. Another built his own specialized microprocessor to accept solar energy information directly from the Center's solar measurement equipment and analyze it automatically for use with the Center's continuing program of solar science.

Writing instructional programs is another popular activity. "The kids get a big kick out of teaching other kids something and writing programs that

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teach," Bill Denlelson, TMSC's computer department director, said.

These progrems have included mineral and plant classifiers which eak the user a series of identification questions about the specimen and use the answers to determine what it is.

One of the more interesting student projects involved fruit fly propagation. The student wanted to demonstrate the rate of increase of a fruit fly population using the fruit fly propagation formula. Normally it takes two weeks for fruit flies to hatch. The student wrote a program to print a colon to represent each pair of fruit flies. He started with a single pair and had the microcomputer calculate how much time it would take to print out each generation on a 30 cps printer. He discovered that if the computer runs at full speed, the actual fruit flies will catch up with it in their fifth generation end the printer will fall progressively further behind after that.

The nicest thing about this approach to learning is that the students learn programming, use of the computer and computer applications to other activities at the same time they are learning the sub-

jects covered by their programs.

Their learning goes beyond the immediate epplications, however.

"One of the reel advantages of the computer is it is easy to construe it as a brain," Danielson said. "It gets the kids

"We are
no longer
a supplement to
our students'
science education.
We are their
science education."

to think very clearly ebout who they are and what the nature of thinking is."

The Quest students ere not the only Computer Center users. Denielson said the Center has been running a large

number of teacher workshops for erea achools interested in developing more applications for the microcomputer in their classrooms. The Center also has younger children in programs; the youngest are the "Fledgilngs," kids going into kindergarten and Grade 1 in the fall. They get one and a half hours with the microcomputers as part of their program of general introduction to science.

The Center relies heavily on its TRS-80s; it has five Model IIIs, one Model I, a Pocket Computer end a Color Computer along with three Apples, one Sinclair and a PDP-11 minicomputer from Digital Equipment Corp. (DEC) that timeshares on several terminals for the most complex applications.

"The important thing is not whether they master Basic or Assembly language but that they have a good experience with the machine at an early age," Danlelson said. "With the increasing intrusion of computers into our professional and privete lives, we are facing a two-cultures problem. We may well find ourselves divided between those who use computers and those who do not."

"Most of these students won't become

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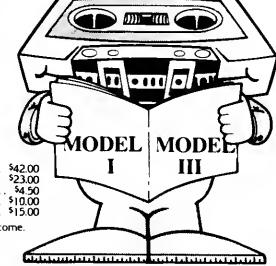
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by Clyde Cload, star reponer



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professional progremmers; they will go out end be engineers, businessmen, writers, and many other things. If they bring a positive attitude towards computers to their work they will be eble to use this tool effectively."

Important Place

In a decade of cutbecks in public education funding, Danielson said TMSC and other institutions like it serve a vital purpose in education. The head of one large Connecticut school system regularly visits public school classrooms on a drop-in basis. In over 100 visits in the last year, he found only two instences where a science lesson was being taught when he visited.

The obvious implication is that only two percent of the students' time is spent on science. In an increasingly technological world, it is ironic that the return-to-basics movement in education is discouraging any change in that proportion.

Under these conditions, Danielson said, "We are no longer a supplement to our student's science education. We are their science education."

College, Publisher Join, Offer Computer Program

The Hawthorne-Green Inc. Institute of Computer Science has been announced by officials of Nathaniel Hawthorne College. The new program will be offered at the Hawthorne campus, located here in Antrim, a small town in the south central region of New Hampshire.

initially, instruction will deal with the fundamentals of computing, with a heavy emphesis on microcomputers. The courses will explore hardware, software, and computer science; future plans call for increasingly diverse offerings of advanced and specialized courses.

The classes will be taught by the Hawthorne faculty and by members of the steff of Weyne Green Inc., located in nearby Peterborough, NH. In addition to publishing several microcomputer periodicals, the firm also maintains an extensive working microcomputer laboratory for

use by its subsidiary, Instent Software, one of the country's major microcomputer software houses.

In the interest of meking the classes available to as many people as possible, the first courses will be held in the evening, two nights a week. Students with no technical background will be eccommodated in the introductory sessions es will the needs of more advanced enrollees. Topics to be covered include date processing and electronic trouble shooting end, eccording to e spokesmen for the institute, the classes are well suited for the person who wishes to prepare himself for a career in the booming technical field. Course participants may also elect to pursue a certificate program or go on to further study under a formal degree program.

The first courses ere slated to begin this month.

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Farmers Group Cultivates Videotex News Database

A new timesharing network for farmers supplying up-to-the-minute information on commodities markets has been etarted by the Professional Farmers of America, Cedar Falls, IA.

The electronic news network, called Instant Update, uses Radio Shack Videotex

"The network offers analyses of events which may have an impact on the market and their possible effects on commodities prices."

16K terminals to distribute a daily morning newsletter, a report on opening prices in the commodities markets, updates on the markets through the day and evening market summaries. It also carries information on market strategies, reports on events in Washington which may affect the commodities market and background and historical information. The network offers analyses of events which may have an impact on the market and their possible effects on commodities prices.

The most recent addition is a database of Gulf Coast grain prices. This is a measure of demand in the market according to Tom McCafferty, marketing manager for the Professional Farmers. He said they were considering adding East and West coast grain prices.

McCafferty said interest in Instant Update has run high among fermers since it was first announced in Januery. The service actually started April 1. McCafferty declined to give the number of subscribers except to say it is "over 500." He seid while subscribership is heaviest in the midwest, instant Update is a netionwide service which even has a subscriber in Haweii

It costs a flat \$95 a month for unlimited access, including rental of the Videotex terminal. It is an interactive service, with the user selecting a detabase from a menu and storing information in Videotex

to read off the television screen.

McCafferty said the newsletter and commodity prices are the most used databases, a weather database the least.

Only Choice

The Professional Farmers chose Videotex because it was the only terminal around. They have been very happy with the equipment which so far has been virtually trouble-free.

McCafferty said relations with Tandy/Radio Shack, Fort Worth, TX, have been good although "they can always be better." He also said they have been weiting for some software from Tandy to allow TRS-80 microcomputers to interface with the system.

Charles Phillips, Senior Vice President for Special Markets for Tandy, mentioned they are actively promoting the idea of private information networks using Videotex terminals. In the long run, he said, Tandy expects Videotex to become a household appliance. Phillips told us they hope enough private networks will take up Videotex to become a household private networks will take up Videotex to become a household appliance.



eotex to create a "critical mass" of homes using it so that as general-interest data services develop they will be designed to be compatible with Videotex. "A lot of people are looking at this form of communication," he noted.

McCafferty said Professional Farmers is a private business offering farmers marketing information and seminars on marketing. Founded in 1973, it has more than 30,000 client-members.

Education Bill Reintroduced

S Rep. Tom Downey (D-NY) has reintroduced his bill to establish one or more national centers of study microcomputer use in education. The bill is being co-sponsored by two members of the House Subcommittee on Elementary and Secondary Education, where it stalled last year. According to a spokesman, Rep. Downey is optimistic that subcommittee hearings will be held on the bill this year.

The bill seeks \$4 million paid over three years to support the establishment of one or more centers to study how microcomputers are used in schools and to make this information available to interested parties in the hope of encouraging microcomputer use in education. However, David C. Smith, legislative assistant to Rep. Downey, warned that it will be tough to squeeze extra money out of Congress for anything this year.

Smith said one big argument for the bill is that the United States is falling behind other countries in this area; even the British, with their much-publicized economic woes, are spending \$25 million to purchase microcomputers and put them in every school in the country. The French have a similar plan already approved and in operation.

"All we want to do is study the uses, we aren't talking about actually buying any machines for schools," Smith said.

Rep. George Miller (D-CA) and Rep. Marlo Blaggi (D-NY) are co-sponsoring the bill this year. Smith said the hope to conduct subcommittee hearings sometime after the August recess.

If the subcommittee passes it, the bill will then be considered by the Committee on Education and Labor. If that committee acts favorably on it, it will go to the full House for consideration.

Anybody interested in expressing an opinion on the bill, labeled HR-2112, to be placed on the record, may write to Rep. Carl Perkins (D-KY), Cheirman, Subcommittee on Elementary and Secondary Education, Room B346C, Rayburn House Office Building, Washington, DC 20515. ■





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A new program, GRBASIC FUNCTION PLOTTER, allows the plotting of almost any function, including polar coordinate based figures, parametic equations, and almost any wave form. Features include function definition and automatic screen scaling, and printing capacity on Line Printer IV. REQUIRES GRBASIC!

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Knossos by Simon Smith

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Knossos is a 3-D graphic simulation. Mazes are represented by a perspective view, as though you are actually there. These graphics are not the simple, square graphics you have seen before. An entirely new representation has been implemented giving a true cave-like quality. And like all Med Systems 3-D graphics, lightening fast screen generation is standard.

Other features include chalk with which to mark the floor for reference points, randomly generated mazes, distance counters for exit, and monster graphics. A typical game might last 15-20 minutes. This is the first truly 3-D arcade game ever offered.

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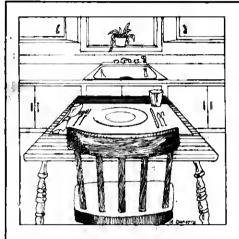
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News From KITCHEN TABLE SOFTWARE, INC.

by David Busch



hat do you get when you take features from both Basic and Cutol? A new language called Besbol. This innovative high-level language, a combination of ANSI '74 Cobol and Dartmouth Besic, hes been introduced for the TLS-8E by Kitchen Table, Inc.

Reguler 80 Microcomputing readers will recall that KTI is the United States' lergest fictitious supplier of spece-age computer products, including DROSS-DOS 1.1 and the TLS-8E. The latter is a new personal computer that is 100 percent downward compatible with the TRS-80 Model I and III.

Basbol was one of six new products unveiled recently by Kitchen Table at the Portage County (Ohlo) Home Appliance Fair. Also making their U.S. debut were a new 5 3/8-inch disk drive, a double-density board end e series of aids designed to treet radietion burns stemming from an initial run of poorly-designed color monitors for the TLS-8E.

Biggest hit of the appliance show, at which KTI was the only computer representative, was the Basbol exhibition. The new language is a compiler/interpreter that is used in a unique way. Very fastrunning object code is generated for rapid testing (although debugging is impossible) and then converted back for run-time operation under the Basbol Interpreter.

KTI spokespersons pointed out that this mode eliminates many errors, because each line of code is interpreted every time a program is run as e sort of double check. At the same time, the compiler (Interpreter) prevents unwanted tampering with the code by the programmer at the testing stage.

A Controversy

One note of controversy surfacing at the display was that Besbol is supplied on a protected disk. The original disk can be becked up only 10 times. It then becomes useless for copying purposes. This will probably not cause much distress for the legitimate user because each backup disk elso cen be duplicated 10 times with no problem.

We suspect this filmsy attempt at protecting Basbol was a subterfuge on KTI's part to make the new software more attractive to program plrates. Much of the firm's Influx of working capital stemmed from the widespread copying of DROSS-DOS 1.1. Though KTI sold less than 300 copies of this DOS over the counter, it has reaped more than \$3 million in profits marketing mandatory Zaps to 111,306 users nationwide.

"The original disk can be backed up only 10 times."

Our suspicions were confirmed on examining the documentation provided for Basbol. It is printed in blue ink on a dark green paper—all but unreadable in original form, but eminently legible when photocopied.

Other products also attracted a lot of attention. KTI's booth was mobbed during exhibit hours. The Da-Glo orange TLS-8E computers really stood out among the dreb Harvest Gold refrigerators and home freezers in the surrounding booths.

New Drives

The product that interested me most was the 5 3/8-inch disk drive now available

for the TLS-8E. These new drives replace the units originally supplied with this computer. Scuttlebutt has it that KTI was experiencing delivery problems with the original drives—customers would take one look at the units and refuse to accept delivery.

Because KTI has been having trouble getting its Sri Lanka factories to adhere to strict specifications, the new drives will accept either the common 51/4-inch minifloppy disks or the occasional 5 3/8-inch ones that slip through inspection. The KTI-100 units are 96-tracks-per-inch drives that can be run either in single or double density. Double-density reliability, using the new KTI Doubloon PC board, is said to be 100 percent that of the TLS-8E in single-density mode. Company spokesmen have promised a remedy for this unfortunate situation in the near future.

The KTI-100 drives may be configured as fixed disk drives merely by inserting a disk and applying furnace ductwork tape over the door to seal the unit shut. Ouite a clever touch.

Since the introduction of the TLS-8E, TRS-80 owners have written to comment. One frequent question is, "So what?" A more probing query runs along the lines of "How can a TLS-8E benefit me, a proud Model III owner?"

So Whet?

My standard answer has been as follows:

- KTI's marketing of the TLS-8E will put a great deal of pressure on Tandy to shape up. With three or four hundred thousand Radio Shack computers already in the field, Tandy has great expectations of selling peripherals, programming, fuses, etc. to this large customer base. Given sufficient provocation, it's conceivable that a quarter of a million TRS-80 owners might decide to switch to TLS-8Es overnight. Then where would Tandy be? Back selling leather belts, that's where!
- Because most software available for the TRS-80 can be used on the TLS-8E, this provides a larger customer base for programmers, and, correspondingly, more softwere available for the rest of us. Inatead of 400,000 Tandy customers, a pro-

grammer has a more attractive market of 400,367 users when TLS-8E owners are lumped in.

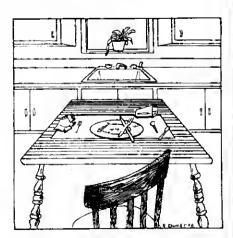
 The TLS-8E provides an attractive "sacond" computer for present TRS-80 owners. Recent upheavals in the international money market have given the U.S. dollar a stronger position when compared to Sri Lankan currency. As a result, KTI has been able to drop the price of the TLS-8E from \$1984 for a two-disk 48K system down to \$179.95.

Obviously, at that bargain price, many TRS-80 Model I or Model III owners are going to want a TLS-8E to carry around to users' groups, on camping trips, etc., where its rugged hard-wiring will better withstand mistreatment.

...the remains can be rewired to make a pretty good garage door opener."

I've heard of many hobbyists who have purchased these machines just as "parts" computers. Need a 1771 chip? Rip it out of the TLS-8E. Interested in finding out if the Z-79A chip would make a good diode? Use one of the two piggybacked into every KTI computer. After you've experimented to your heart's content, the remains can be rewired to make a pretty good garage door opener.

I gleaned all these tidbits from brief interviews with the raclusive founder of Kitchen Table Inc., who prefers to remain anonymous. We agreed to abide by Scott Notan Hollerith's wishes and pass along these interesting comments to you without any attribution.



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THE EXCLUSIVE ORACLE

by Dennis Kitsz

"I have yet to see you name programs that are no good. You are culpable in not disseminating this information. Must we continue to get ripped off?"

Q. I recently wrote a Basic program with machine language interfeced within it. I found it was fester to save the Basic pert of the program together with the machine lenguage routines by using T-Bug, than to load them seperetely or to POKE them in. The program works perfectly when saved this way except for one thing: In order to list the program, it is necessary to type Clear and hit enter before typing LIST. If you don't the computer will List the first line end stop. If you run the program end then List it, it works fine.

My questions: Why is it necessary to type Cieer, can you get around it, and why is it necessary to type ?MEM efter returning from some mechine-lenguage progrems? I know that this eliminates errors that occur if you don't, but what causes these errors in the first place? Also, is there any way to get a Basic progrem to run from a machine language introduction? I have a progrem written, but the introduction is in machine language, is it possible for the machine language routine to start the Basic progrem running when the introduction is finished?

Nethen W. Herrington Nelson, Nebreske

A. Welcome to Software Interfacing 101: Getting in and out of Besic with no help from Fort Worth. Your first question brings up an interesting topic. The Clear aubroutine is used quite often by Besic—after executing Clear, ot course, but also efter New, CLOAD, and Run. its purpose is not only to clear out ell veriables (actually this is a consequence of the routine, not its main objective), but also to reset properly all the line pointers in the Besic listing. What are line pointers? Basic picks its wey through a program lieting in two ways—by knowing a line's number (stored in binary) and also by knowing ahead of time the memory address is its "pointer".

The Clear routine autometically sweeps through the entire Basic program, edjusting line pointers according to where it finds the ends of lines. Depending on the condition of the Basic program when you first seved it to tape using T-Bug, your subsequent loed attempts may actually be putting it in an area different from the one you expect. Hence, there is an incorrect or truncated list. In your case, the line pointer that should be locating the second line of the program is instead pointing back to the first line. Since Run also uses the Clear routine first, that explains why the program is automatically corrected by running it. The address of the Clear subroutine, if you wish to usa it before returning to Besic, is 1E7A hex.

The reason you have to type ?MEM (or something similar) when returning to Besic from some mechine lenguage progrems is because meny progremmers took Redio Sheck at their word. In the original Editor/Assembler menual which so meny programmers used, return to Besic was listed as address 1A19 hex. However, that address works only under certain conditions; registers heve to be loaded and the stack pointer set up

for re-entry without en ?OM Error message being printed upon entering the first Basic commend. A better Basic re-entry point is 06CC hex, which evolds both the ?OM Error message and rebooting a disk system.

Finally, there is indeed a way to get a machine lenguage routine to start your Basic program automatically. Here's the order: register Hi. is loaded with 41E7, just before the beginning of the keyboard input erea. Memory location 41E8 is filled with Runtoken 8E, and location 41E9 is filled with line terminator 00. Next jump to the master command execution routine, 1D5A. This is how it looks in assembly language:

LO	HL,41E8H	: Get line buffer location
LO	(HL),8EH	; Place RUN command token
INC	HL	; Move to next buffer place
LD	(HL),00	; Close out the line buffer
QEC	HL	; Move back in the buffer
DEC	HL	;to before the beginning
JP	1D5AH	; And bow to master executor.

Q. I've got a Model I Level II 16K mechine with a problem. The computer runs fine until i run this program:

- 10 READ A.B.C 20 PRINT A.6.C
- 30 OOTO 10
- 40 DATA 1,2,3,4,5,8,7,8,9

When I run this program I get:

1 2 3 1 2 3 1 2 3

etc.

I've eliminated the Z80 and eight 16K chips by replacing them. I've had this computer since 1978 and I've installed a lowercase modification in it. I own T-Bug and TLDLS but I haven't figured out how to use them yet. How can I figure out which chip is bad?

SSgt Terry L. Kuns APO New York

A. The bad chip is your Level II ROM. However, don't replece it as the electronics eren't bad. There's a bug in the first version of Basic. It's too bad you peld for a new Z80 and 16K memory to find that out. Here's the solution. Whenever you are using any program that does tape I/O or performs Read/Data combinations, be sure this line appears somewhere at the start: POKE 16553,255.

Q. I appreciated your January column about the programs you have found to be useful. But, I have yet to see you come out and specifically name programs that are no good. Surely in finding the good stuff, you have found a lot of junk. I feel you are culpable in not disseminating this information, especially when you have written about the stuff that is good. If the authors, such as yourself, who heve en audience don't tell us, then must we continue to take a chance and continue to get ripped off?

Lerry Morgan College Place, Washington

A. This column might seem an unusual place to answer Larry's letter, but I've received a lot of meil from TRS-80 users who feel they have been burned. Besides, bad software qualifies as a TRS-80 problem (see the answer to SSgt Kuns's letter above). Okay, there are enormous numbers of programs which I believe qualify as junk—some are given away, some are sold for outrageous prices, and some appear right in the pages of this megazine. Were I to name them, however, I would be overwhelmed with mall from people for whom such programs serve a valuable purpose. On the other hand, even the best of programs aren't good enough for those born of IBM.

Okay, cop-out, you say. But really, what is a good program? Perhaps the thousands of meticulously crafted games of video violence which are published and sold? Not for my taste; it seems Klingons are only what you want to call them. How about compilers and other software with the name Fortran? As far as I'm concerned, keep 'em. I use Fortran as much as I use my yeers of high school Latin. And if I ever see another universal celendar, hex-decimal converter, Basic word processor, telephone dieler, checkbook minder, or elien invader game—I'll scream.

But does thet mean I should pan one of these programs and damage both the author's credibility and pocketbook? You don't know me or any reviewer by more than what we write, end that's hardly a keyhole into our likes and dislikes, our capabilities and ahortcomings. The best helping hand I can give is to tell you what I teel is good. Besides, if I believe it's awful, I'm probably not going to use it long enough to tell you why.

(For a complete list of software that I hate, please send a self-eddressed, stamped envelope, together with \$5,000, to. . . .)

Q. I hate to bother you again. I have had a video bug in my '80 for as long as I've had the computer (D board, bought used a year ago). When I have much of the screen whited out, the border around the portion of the screen that is not whited out warps, as in the sketches in Fig. 1.



Fig. 1 Warped Screen

When the entire screen is whited out, it has nice square edges, but when a bleck rectangle appears inside, the white

outside the border warps. It Interferes with a Breakthrough game I just purchased.

Men Del Cooper

A. The problem is inherent in the video monitor, which is little more than a stripped television with repackaging (there are dial holes under that TRS-80 insignia) and a little electronic tweaking. Different generations of monitors were of different quality. Open up the monitor (with it unplugged, of course!) and look inside for the vertical circuit board or boards. If you have a single vertically mounted board, find resistor R????. Piggy back on it e 3,300-ohm, five-percent resistor (orange-orange-red-gold). You're ell set. If you've got two vertical boards, or you went an even better fix, Archbold Electronics (10708 Segovia Way, Rancho Cordova, CA 95670) has an excellent video perkup board for about \$11, with full instructions.

By the wey, Men Del's belky power supply (August) turned out to be caused by a corroded screw clamping the power transistor against the circuit board, causing the voltage to go off intermittently. Emery paper and a hefty screwdriver cured the problem completely.

Q. Just what is the purpose of the terminating resistors in TRS-80 disk drive 21-1160? I have two Radio Shack drives and a four-place Radio Shack cable. I'm planning to get an additional non-Radio Shack 40-track drive. All the ads claim that their drives are compatible with the TRS-80, but when asked where the drive is placed relative to the Redio Shack drives, the edvertisers avoid the question. Can you use the seme Radio Shack cable for the non-Shack drives? If I wanted to send my Radio Shack drives in for repair, could I use the non-Shack drive alone? If I use all three together, where do I put the non-Shack drive? Do I have to advise the seller of the non-Shack drive that I intend to use it with Radio Shack devices?

Lawrence E. Pyle No Return Address

A. The hardware aspects of combining 35 and 40-track drives are not complicated, but let me first explain the purpose of those mysterious terminating resistors. Digital electronic circuits come in various families to suit electronic and environmental needs. When long signal lines are involved, it is often wise to use circuits which are activated at the far end of the signal path. It is that kind of "open collector" circuit (see August Applications for e fuller explanation) which is used to activate the disk drives. In order for this circuit to respond, however, the open path must be closed. The termination registors perform that function. One set is enough as too many can be damaging.

If you have a Radio Shack disk drive cable, the drive definitions (0, 1, 2 and 3) are built into it. Other drives will work fine with that cable, but be sure to explain carefully to your vendor that you are purchasing a third drive (called drive 2) and wish it shipped without termineting resistors and with the select jumper properly wired. If you've settled on a good retailer, you will have no problem with this.

if you have to switch drive positions, you might want to follow another course. Your most flexible drive should be in position 0, because this drive should be able to read all 40 tracks on the disk. It gets more work to do than the rest in

THE EXCLUSIVE ORACLE

checking directories, reading, saving, formatting, and such.

It gets tricky now. if you are using TRSDOS, you have aseentially a 35-track DOS which will Ignore the axtra tracks on your haw driva. NEWDOS was one of the first to handle 40-track drivea, and virtually sil naw disk operating systems can do that and mora (LDOS claims it can mix'n'match). First, decida if you wish to access those additional five tracks; if so, check 80 Microcomputing's recent DOS issue and consider an operating system other than TRSDOS. When you have obtained it, check to make sure your Radio Shack drives are 35-track drives. Many wara specified as 35-track units to maintain compatibility, but ara actually 40-track davicas.

If you have only 35-track Radio Shack drives, then I would suggest your naw 40-track drive be wired for position 0, with the terminating rasistors instellad, and that you move the 35-track Shack drives to positions 1 and 2. Remove the terminating resistor package from the Radio Shack drive by unscrawing the cover and finding the sockated, integrated circuit-like package (usually colored blue and sometimes marked 1E) and pulling it

out.

You may elso have to rewire the drive-select jumper (position 1F), though this is unlikely. If the DIP shunt is intact, leave it that way and dapand on the Radio Shack cable to make the drive salaction. If some shunt bars are broken, then you will have to reconnect the ones you need, and break the others. Pin 1 connected to pin 14 salects driva 0; pins 2 and 13 select driva 1; pins 3 and 12 select drive 2; and pins 4 and 11 select drive 3. Your TRSDOS manual has all the circuit details.

Updates

Many readers have asked how Z80 mode zero and mode two interrupts could be used with the TRS-80. I thought about the problem and came up with a typically mundana solution involving piggybacking an integrated circuit and running a wira or two. Evarett B. Ogdan of Dalmar, Naw York, had a bettar idaa:

There are at least two easy ways to use these interrupt modes, one of which requires no Internal modifications.

The Internal mode is cleaner: If you never intend to use the Test Input, cut it loose from Z53 pln 4 and connect the INTAK output to that pln.

Those who don't want to attack their keyboards can its INTAK to Test on the edge connector. At first glance this would seem to generate a bus request, which has priority over interrupta. Studying the Z80 timing diagrams will show that this doesn't happen. The Z80 samples the bus request input only at the start of the last T-state of any M cycle (T4 for an M1 cycle). INTAK, the combination of M1 of IORO, ands at the start of T3, so the Z80 does not see it on the BUSRO line. The messy part is that the Test input also tri-states the address lines, In, Out, RO, WR, RAS, CAS and MUX. The INTAK pulse is short enough that refreshing isn't a problem, and if the In, Out, RD and WR lines are pulled high, it doesn't matter what happens to the address lines. Resistors could be used, but tri-state buffers are better.

Special thanks to Mr. Ogdan for a ramarkabla piece of insight.

Readers please note that Radio Shack has discontinued the National Semiconductor data books. I highly recommand thasa rafarences (aspacially tha TTL and memory books), which are available from National Semiconductor (2900 Semiconductor Driva, Santa Ciara, CA 95051), Digi-Key Corporation (Hiway 32 South, Thiaf River Falls, MN 56701), and other distributors. ■

Desperata? Send your questions on Model I, Level II, TRS-80s to: Dannis Bathory Kitsz, Roxbury, Vermont 05869



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NEW PRODUCTS

Edited by Janet Fiderio

Littie Big Lisp

Little Big Llsp, for the Model I, is available from the Department of Computer and Information Sciences at the University of Oregon.

Lisp includes the Lisp interpreter, a Lisp compiler, a trace peckage for monitoring the execution of programs, a Lisp structure editor, the RLISP programming lenguage which provides a high level language interface to Lisp which resembles Algol and Pascal, and some sample programs in Lisp and RLISP.

The system requires e minimum of 32K and is available on a 5 1/4-inch disk complete with documentation for \$30. Complete source listings are available on magnetic tape for \$100. For more information contact Jed Marti, Department of Computer and Information Science, University of Oregon, Eugene, OR 97403.

Reeder Service - 167

Color RAM/ EPROM Cartridge

The CMEMORY plug-in cartridge for the Color Computer can supply the user with up to 8K of continuous memory which can be divided into any combination of 2K blocks of RAM Memory and/or 2176 EPROMS. This product allows you to save frequently used utilities or games in easy-to-use cartridges.

CMEMORY uses the unused address space \$C000 to \$E000, normally used for plug-in game cartridges. By edding a jumper, the computer can be set to automatically execute a program in EPROM whenever the Reset button is hit.

The CMEMORY cartridge sella without any memory for \$24.95. 2K RAM chips are aveilable for \$19.95 each, 2K 2716 EPROMs for \$14, or you can use your own memory. Available from Micro-Lebs, Inc., 902 Pinecrest, Richardson, TX 75080, (214) 235-0915.

S.A.T. Preparation Series

Krell Software has expanded its College Board S.A.T. Preparation Series from five to 25 programs. It now includes sections on word relationships, vocabulary, sentence completion, reading comprehension and mathematics.

The programs are based on past examinations and present material of the same level of difficulty end in the same form as used in the S.A.T.a.

These programs are available for the TRS-80 for \$299.95, from Krell Software, 21 Millbrook Dr., Stony Brook, NY 11790, (516) 751-5139.

Reader Service ≥331

Color Computer Game

Packet Man, a popular arcade game, is now available for the TRS-80 Color Computer.

Written in machine code, this game provides the graphics of the Color Computer with the speed of machine code.

The cost of the program is \$24.95. A Level II 16K machine is required. Inquiries should be sent to American Business Computers, 118 South Mill St., Pryor, OK 74361, (918) 825-4844.

Reader Service ≥333



The CMEMORY Cartridge

Programs for Beginners

Programs for Beginners on the TRS-80 is written for the computer novice. Written by Fred Blechman and published by the Hayden Book Company, the book provides instruction through 21 progrems that run on a Model I and Model III TRS-80.

Programs include topics concerning business, bookkeeping, calculating loan interest, mortgage payments, investment evaluation, and others. The four appendices include a video display worksheet, cassette-loading time charts for Level I and II, and a complete description, schematic and parts list for an audio/visual control box.

This 150 page book costs \$8.95 from Hayden Publishing Co., Inc., 50 Essex St., Rochelle Park, NJ 07662, (201) 843-0550. Reader Service ∠162

D-CAT from Novation

The D-CAT from Novation Is a directly coupled modem that Is FCC approved for handset jack connection with any modular phone. It operates with either single or multi-line phones without the need for adapters.

D-CAT transmits data over telephone networks allowing one computer or terminal to talk to another. The direct connect feature eliminates distortion and lostdata problems.

It is available for \$199 from Novation, 18664 Oxnard St., Tarzana, CA, 91356, (213) 996-5060.

Reader Service ~349

Lazy Writer

Lazy Writer, a word processing system, is available in a new Model III version and an enhanced Model I version 1.8.

The program is capable of reverse (hanging) indents, superscripts and sub-

scripts, offsetting text to the right, precise printing from cursor position, and printing chained files.

Lazy Writer also provides a communications program that works with a modem. The Model III version has an enhanced communications package, allowing stored characters to be sent with a single key stroke for log-ons, provides a "local" echo, and will receive a full eight bytes.

Lazy Writer is priced at \$125 for the Model I and \$175 for the Model III. It is distributed by Soft Sector Marketing, 6250 MIddlebelt Rd., Gardan City, MI 48135, (313) 425-4025.

Reader Service -336

QSO Log for Ham Radio Operators

QSO Log, from Manhattan Software is directed et emateur radio operators.

When a call sign is heard on the air tha operator using QSO Log enters the sign into the computer. OSO Log will list call, name, QTH, date, time, band, and notes on conversation and on the contact's equipment.

The program dumps to tape, loads to tape, and allows on-screen review of all QSO records. It also allows updetling, editing and deletion of entries and printout.

The cassette version (16K or 32K) will run on the Model I or III and is priced at \$14.95. For additional information contact Manhattan Software, P.O. Box 1063, Woodland Hills, CA 91365, (213) 704-8495. Reader Service ~339

Agricultural Software

Two new programs evallable from Agricultural Software Consultanta, require a Model I or Model III with one disk drive, 32K memory and an 80-column printer.

The first program, FEEDDATA, is designed for feed mills and nutritionists. It stores and retrieves feed data on disk and calculates the composition and nutritional value of any combination of these feeds. FEEDDATA is priced at \$60.

MIXIT-2 is designed for feed mills, feed lots, dairymen, and poultrymen to determine the "least cost" for any feed mix and more. MIXIT-2 is priced at \$200.

For more information on these two programs, contact Agriculture Software Consultants Inc., 1706 Santa Fa, Kingsville, TX 78363, (512) 595-1937.

Reader Service -348



Magnetic Media Preservers

Shield your Magnetic Media

Durable metal cases which protect magnetic media from magnetic fields that cause degradation and erasure are now available.

These metal cases are magnetic media preservers designed for carrying or storing. Models include cases for the 5 1/4 inch and 8 inch flexible disks. A cassette tape preserver is also available.

For more information contact the Magnetic Shield Division of Perfection Mica Company, 740 N. Thomas Dr., Banville, IL 60106, (910) 766-7800.

Reader Service -341

The Boss

The Boas is an accounting software package which has integrated all accounting functions into one program. This software offers capabilities such as comprehensive financial ratio analysis, loan payment calculations, amortization schedules, depreciation schedules and statement of changes in financial position.

It has combined accounts payable, accounts receivable and general ledger so they can be accessed at any time during the program run. The Boss runs under CP/M.

For more information on this accounting management tool, contact Lifeboat Associates, 1651 Third Ave., NY, NY 10028, (212) 860-0300. The Boas is priced at \$2,495.

Reader Service -350

Exam Preparation Programs

A series of Competency Exam Preparation Programs are available from Krell Software.

These programs consist of simulated exam modules, a diagnostic package, and a complete set of instructional programs. They are designed to teach concepts and operations, provide drill and practice, and to assess achievement levels. The series provides a curriculum encompassing mathematical, reading and writing instruction.

The CEPS are available in two software formats: the National Proficiency Series, end the NY State Regents Competency Test Preparation Series. Both are priced at \$1,299. For more information contact Krell Software, 21 Millbrook Dr., Stony Brook, NY 11790, (516) 751-5139.

Reader Service -332

Snapp II Extended Basic

Snapp II Extended Basic is written in machine language to increase execution speed. Extensions are fully integrated into Model II Basic and require no user memory or disk space.

Snapp II includes a cross-reference ability, the ability to display and print program variables, a program line renumbering ability, a cross reference facility for key words or character strings, and the ability to compress a program to the absolute minimum.

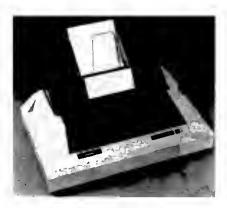
It is available for the Model II for \$200 and the Model III for \$125, from Snappware Inc., 3719 Mantell, Cincinnati, OH 45236, (800) 543-4628.

Reader Service -185



The Boss

NEW PRODUCTS



The Anadex Dual Mode WP-6000

The Anadex Duai Mode WP-6000 Printer

The W.3-6000 dot-matrix serial printer from Anadex provides high speed operation and is capable of 150 cherecters par second in the latter-quality mode and up to 500 cps in the data processing mode.

This printer features an 18-needla, dotmatrix print head consisting of two vertical rows of nina needles elightly offset from each other in the vertical dimension. Graphica capability is also provided. The WP-6000 can print e variety of foreign fonts and features bi-directional, logicseaking operation, standard interfaces of RS-232, current loop or parallel (Centronics), and friction feed with an optional adjustable tractor feed.

The WP-6000 costs under \$1,800 and is available from Anadex, Inc., 9825 DeSoto Ave., Chatsworth, CA 91331.

Reader Servica ~346

TurboDOS

TurboDOS is a new disk operating system for the Model II, compatible with Digital Research's CP/M, version 2.x.

TurboDOS features file management facilities, a sophisticated buffer manager, a reentrant file manager, automatic print spooling, e command languege interpreter, and a command file processor. Other capabilities include an extensive set of utility programs, system date and time functions, standard communications channal interface, and more.

A special Introductory price of \$195 for the spooling version is being offered from Data-RX, Inc., 686 Lighthouse Ava., Montery, CA 93940, (408) 375-2775. Reader Service >342

Mailing List System

Precision Prototypes has announced an improved TRS-80 (Modal I or III) malling list system to use with large lists. Features include maintenance of all disks in continuous alphabetic or zip order, high speed sort and disk retrieval, and up to 4640 (for Model III) addresses on-line. Two 80-track drives are required.

The eystem is epecially gaared to use advartising statistics in selecting and purging names for print outs.

Hardwere requirements are 32K, two disk drives, end e printer. The system is available for \$69.95 from Precision Prototypes, 410 E. Roce, Refugio, TX 78377. A documentation menual is evailable separately for \$3.95.

Reader Service -344

Card Reader Interface

Chetsworth Data Corporation has developed a special interface to the TRS-80 Model III for its MR 500 and OMR 500 cerd readers. The interface plugs into the I/O bus jeck of the Model III.

A software driver and Interface that enables the user to input data is supplied with their reader. The MR 500 reader utilizes en electric current technique for reading soft pencil marks; the OMR 500 is an opticle reader.

Educational applications for the TRS-80 Include grading tests, attendance and grade reporting, and teaching programming. Businesa applications for the reader include inventory, labor distribution and time card recording.

For more information on this product contact Chatsworth Data Corporation, 20710 Lassen St., Chatsworth, CA 91311. Reader Service ~ 164



The Chetsworth Cerd Reader Interface



The Ramlok Memory Protection System

Memory Protection System

Ramlok is a computer equipment protection system that conditions supply line voltage and supplies a safe operating environment for electronic equipment, especially computer memory circuits.

Ramlok filters line voltage with a dual T section RFI filter. It ensures correct voltage limits and provides proper filtering to suppress RFI line noise and an uninterruptable power supply capability. The user provides the bettery/inverter, Ramlok provides regulation control, filtering, battery charger, feilure Indication and multiple circuit and the power distribution panel for equipment connection.

It is sold for \$495, from Ladco Development Co., Inc., P.O. Box 464, Olaan, NY 14760, (716) 372-0168.

Raader Service > 160

The RAM Communication Area

The RAM Communication Area is a booklet which is Intended for the TRS-80 computer owner.

It is a concise description of the Level II memory locations from 16384-17128 (4000-42E8). The booklet also contains an article dealing with number conversions.

RCA is priced at \$4.50 and is eveilable from ABS Suppliers, P.O. Box 8297, Ann Arbor, MI 48107, (313) 971-1404.
Reader Service ~335

Loan Amortization Scheduie

This program allows the user to print a schadule of loan repayments along with monthly and yearly principal and interest data. One of the options automatically adjusts the pay data away from weekends and holidays. A built-in calendar ensures accuracy to the year 2099.

The program is available for \$19.95 on tapa for the TRS-80 Models I, II, and III. Contact Precision Prototypes, 410 E. Roca, Refugio, TX 78377.

Raadar Service -347

Color Computer Newsletter

Rainbow is a newsletter devoted solely to owners of the Color Computer and will be available every month.

A typical issue of Rainbow will contain feature stories, hints and tips on operation, sample programs and reviews of Color Computer-essociated hardware and software.

Annual subscriptions sell for \$12 end can be ordered through Rainbow, 5803 Timber Ridge Drive, Prospect, KY 40059. Reader Service ~328

Football Scouting

The Football Scouting Report is a system of programs that analyze running, passing, and kicking plays. They run on a Modal I or a Model III with 32K, one disk drive, and a printer.

A taam can be scouted up to five times before running a composite analysis, or each game can be analyzed separately. The package consists of eight programs that are suitable for both college and high school use. They are available from Precision Prototypes, 410 E. Roca, Refugio, TX 78377 for \$89.95.

Raadar Service -340

Isaac Newton

Isaac Newton is the nama of an educational game which challenges players to assemble evidence in support of particular laws of nature.

It is an inductive game allowing players to intervane actively in detarmining if new information supplied by the computer conforms to the laws of nature in question.

Isaac Newton is available for the TRS-80 for \$24.95 from Krall Software, 21 Millbrook Dr., Stony Brook, NY 11790, (516) 751.5139

Reader Service -330



K-8 Math Cross-Reference

K-8 Math Cross Reference

Radio Shack is publishing the K-8 Math Cross Reference to be used in conjunction with their computer-based educational programs for kindergarten through eighth grade.

This teachers' reference coordinates the lessons in the K-8 meth program for the Model I and Model III to materials in six of the most commonly used elementery math taxtbooks.

The price of this reference manual Is \$4.95 from Radio Sheck, 1800 One Tandy Center, Fort Worth, TX 76102.

Reader Service ~181

300 Baud Modem

Kese Company has introduced the DataSpeak O/A-300, a compact, low cost, 300 baud modem that connects directly to the telephone line with FCC pert 68.

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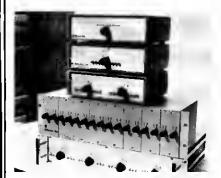
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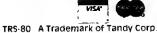
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humanity i love you because when you're hard up you pawn your intelligence to buy a drink.

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F. Scott Fitzgerald (1896-1940)

The fact that a man knows right from wrong proves his intellectual superiority to the other creatures; but the fact that he can do wrong proves his moral inferiority to any creature that cannot.

Mark Twain (1835-1910)

We should not pretend to understand the world only by the intellect; we apprehend it just as much by feeling.

Carl Gustav Jung (1875-1961)

Intelligence...is the faculty of making artificial objects, especially tools, to make tools.

Henri Bergson (1859–1941)

Artificial Intelligence— Technology and The Search for Self

by Chris Brown Technical Editor

n the early 1950s, two seemingly unrelated events took place. The first was the airing of an episode of the popular television series, "I Love Lucy," in which the lovable redhead and her zany companion Ethel found themselves working on a high speed bon-bon production line. The second was the publication of a scientific paper by Alan Turing titled "Computing Machinery and Intelligence." Worlds apart in audience and approach, these events were, none-the-less, related. Turing's paper posed, for the first time, the philosophical question-"can machines think?" The "I Love Lucy" episode illustrated the essence of intelligence and thinking that Turing was forcing the scientific community to examine.

Turing's thesis, that machines could indeed think, quickly drew fire from philosophers who eagerly mired his theory in arguments over semantics. What, they demanded, do you mean by "thinking?" What is a machine? How is intelligence defined? Though they posed questions worthy of consideration, the philosopher's linguistic nitpicking dld nothing to further the cause of scientific inquiry. It did allenate the early Artificial Intelligence community to the point of inaudibility, however.

Semantics were of no concern to Lucy and Ethel. All they knew was that in their immediate environment that damn conveyor belt was supplying bon-bons faster than they could pack them into boxes. So, in a desperate attempt to keep their jobs, they began to eat every tenth bon-bon. Then, as the belt speeded up, they ate every fifth, every third and eventually, every other. Finally, with cheeks bulging like October chipmunks, they ate every bon-bon that came down that line. Though feeling increasingly queasy, they had done what no machine had yet been able to do. They had adjusted their behavior to their surroundings in accordance with the demands of changing conditions. They had adapted and in doing so displayed the intelligence that Alan Turing believed computers would one day be capable of.

"Ask those involved to define what they are researching... You'll get as many definitions as you have researchers."

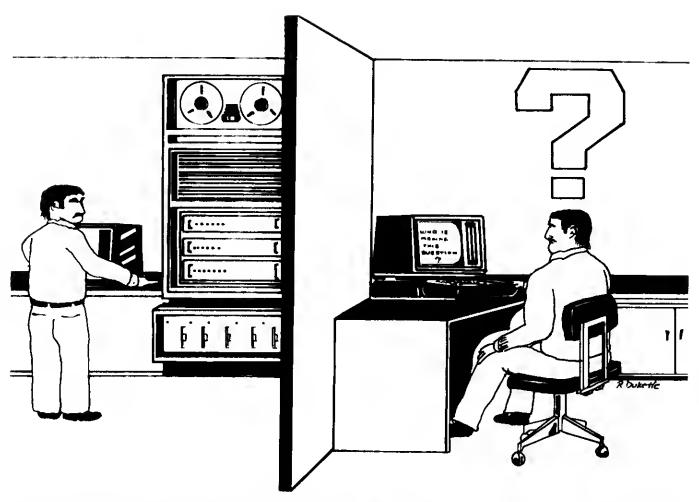
Technologically, we have come a long way since the days of "I Love Lucy" and Alan Turing. We still don't have computers that perform as well as Lucy and Ethel, however. Philosophers and artificial intelligence researchers are still arguing over semantics and methodology. And

most important, Alan Turing's question, "can machines think?" has yet to receive a satisfactory answer.

What It is

What exactly is artificial intelligence (Al)? In essence it is a method by which we can learn about the nature of knowledge and the nature of man, ironically, the most functional definition of Al lies with the man who originally broached the issue, Alan Turing, His Turing Test is not concerned with the methods used to produce intelligence but, rather, with the end results. In a modern day version of the Turing Test a human subject is presented with a keyboard and a video monitor which he uses to converse with two unknown sources of Information. One of these sources is a machine, the other a human. Though the subject is aware he is dealing with one man and one machine, he does not know which is which. By interrogating his sources, the subject must determine which is the machine. If he fails to do so better than 51 percent of the time, the machine can be sald to have successfully simulated human intelligence. So far, no machines have passed this acid test. Increasing numbers are coming close,

Ask the people involved in the research to define what exactly it is they are researching and you will get as many definitions as you have researchers. The fact is that AI is a vague field that encompasses the least understood aspects of human existence, conscious and unconscious thought. Patrick Winston, an AI veteran and member of M.I.T.'s artificial intelligence group, defines artificial intelligence research as "the study of ideas which enable computers to do the things



that make people seam intelligent." Philip Jackson, a textbook author and AI researcher for Xerox offers, "AI is the ability of machines to do the things that people would say requires intelligence." Abe Lockman, an AI researcher and professor of computer science at Rutgers University says, "AI involves the creation of systems that simulate intelligent human functions and that handle I/O in a manner similar to the way humans do." The salient feature of each of these definitions is the simulation of intelligent human thought by a machine.

The Goals of Al

it is possible to get a clearer idea of what AI is about by examining its goals. In a succinct statement of purpose, M.I.T.'s Patrick Winston Identifies AI's goals as follows: "The central goals of AI are to make computers more useful and to understand the principles which make intelligence possible." The first goal, making computers more useful, is the easier of the two to attain and many of the techniques developed during the course of AI

research are routinely used in both programming and hardware design today. Some of these include the structures for languages like Lisp and Logo and the methods of expert systems analysis.

The second goal of artificial intelligence, understanding the principles of intelligence, is not so easily achieved and has much broader ramifications. In Al's continuing search for a mental model that closely resembles the human thought process, many theories have come and gone. At first it was believed that the study of problem solving, pattern recognition and theorem proving would yield the most accurate model of human thinking. Over the past ten years, however, the emphasis has shifted eway from these areas. Today, many researchers feel that the key to unlocking the secrets of human cognition lies in discovering how we process language. In university laboratories ecross the country projects are underway to determine just that.

Programe That Read

At Yale, computer programs with names

like Sem (Script Applier Mechanism), Frump (Fest Reading and Understanding Memory Program), Pam (Plan Applier Mechanism) and Politics have been developed in efforts to validate theories about lenguage processing.

Sem is a program that understands stories that have been written according to scripts (data structures that describe situations in certain ways). Sem is capable of creating its own concepts of what has happened in a story by persing sentences and drawing inferences. It can provide paraphrased versions of stories that are longer than the original by eleborating on what it has learned from its reading.

Frump is a similar but more flexible program. Frump skims a newspaper from beginning to end looking for subjects in which it is interested. Once it finds a relevant subject, it applies the rules of a gremmar to determine the information if wants to know. Frump is a fest program by Al stendards and its paraphrased summarles read like the copy of newspaper night shift rewriters. In addition, Frump is virtually language independent, it is easily able to

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"What do you mean by "thinking?" What is a machine? How is intelligence defined? The philosopher's nitpicking did nothing . . . "

paraphrase in English, Spanish and Russian, depending on which grammer is in its database.

Hawke and Doves

Politics is a program that uses a database of political philosophy to answer hypothetical questions regarding the motives behind (and consequences of) certain political actions. It accepts input in the form of questions, examines its data base and supplies answers in tersely worded sentences that would be much too concise for most State Department spokesmen. When loaded with its conservative/hawk database and asked why the Russians had massed troops on the Czechoslovaklan frontier, the program answered, "Because Russia thinks it can take control by sending troops in." When asked what Russia would do next, it answered, "Order its troops in." When asked what the U.S. could do about the situation, it suggested, "Intervene militarily." Loading in the liberal/dove database would have resulted in different answers. Politics is used to supply scenarios of hypothetical situations according to the tenets of various political philosophies. At present, programs similar to Politics are helping decision makers examine the consequences of their actions before things have gone too far.

In all these programs, researchers have been able to get machines to interpret language and draw Intelligent conclusions. In fields like medicine and geology, programs such as these have already performed at the level of human specialists and experts. Whether helping to diagnose bacteriologic infections from a myriad of symptoms (MYCIN) or predicting the location of natural resources from existing geologic conditions (Prospector), the value of such programs to society is obvious. This is the practical aspect of the often esoteric field of artificial intelligence. On a larger scale, Al can help philosophers, psychologists and linguists in their work by allowing the integrated thought processes each of these people study to be dissected, examined and mimicked by machines.

Conservetive Outlook

For Abe Lockman and other researchers, Al is a promise of the future. Unfortunately, over-zealous members of the Alcommunity have damaged their own credibillty by making promises they have not yet been able to keep. Today, most Al peo-

ple are more conservative in outlook than they were ten years ago. They prefer to emphasize the small, but real, gains being made rather than speculate on what might

Lockman told 80 Microcomputing, "Many grandiose claims have been made about what Al has done. In my opinion, we have not come very far. Sure, we have programs that sit up and bark in toy domains, but the real problem is how generalizable are these theories of intelligence?" In his Al-oriented computer department at Rutgers, Lockman's 700 students, many of whom are interested in careers in artificial intelligence, are being taught the principles of natural language processing.

Lockman says, "In my research I'm looking for the mechanism that allows a human to instantly get full understanding of a text, I believe that all of our knowledge of the world is brought to bear on each word we read. I want to know how that knowledge is organized and, especially, how it is accessed by our brains," Lockman admits that he is a long way from the answers to these questions. In fact, he hasn't yet used the computer to validate his theories. He candidly admits, "I haven't programmed my theories yet because, unfortunately, I'm able to disprove most of them on paper,"

When asked about the future of Al. Lockman was skeptical. "I see no major breakthroughs on the horizon. We will continue to build our limited systems and basically do more of the same." On a more optimistic note Lockman indicated that some progress will occur due to the increasing cooperation between the traditionally warring camps of Al theorists. philosophers, linguists and psychologists, all of whom are taking an increased interest in each other's work.

Turning To Science

The most intriguing thing about Al research is that it is an investigation of self: how we think, why we interpret as we do, and ultimately, who we are. Man has been perplexed by his existence since earliest history and has used myth, religion and magic to explain his existential dilemma. In our post-industrial, hightechnology age we are increasingly turning to science for answers to the timeless questions of existence. By providing us with a clearer understanding of the human mental process, artificial intelligence research may eventually lead us to a better understanding of self.

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Then came Copernican astronomy...
Once man was a being apart from the rest of creation.
Then came Darwin and avolution...
Once man understood his own behavior.
Then came Freudian psychoanalysis...

And Now Artificial Intelligence

Harold Nelson Kilobaud Microcomputing Technical Editor

There have always been those who view such developments as blows to man's humanity, his uniqueness and superiority. But, by and large, such developments in man's understanding of himself have been irresistible, beyond suppression. We seem to yearn to more fully understand what we are. Artificial Intelligence (AI) may be the latest field of research to give us new tools to extend that understanding. Getting a feel for what AI is all about could lead to some astonishing insights.

Roast Mulee

Can you rearrange the letters of roast mules to form one fairly common English word? (It's something most first graders can do.)

Once you solve that puzzle, can you write a program that can reproduce what you have done? Can you write a program that can solve the puzzle?

It might seem that once we have solved it, writing the program should be easy. In principle (which is something quite different from practice), it might be.

One way to solve a puzzle like this would be to list all permutations of the letters, then pick out the word (I think there is only one). Even If we started to seriously consider this method, the fact that there are 3,628,800 such permutations would soon cause us to abandon it. We would be more likely to start arranging the letters into familiar groupings-syllables-then rearrange these until we found the word. That still is not es eesy as it sounds. But when we do this something else is occurring. There are quite a number of combinations (such as oaue and sartim) that we just do not consider—that we reject "without even thinking about It." Certain combinations (i.e., eounds) do not occur in our language. so we don't even think about them. Others do, and we work with those. What usually happens is that we chance upon one or two of the proper syllables and the solution seems to jump out at us.

How do we write a progrem that can do that? What is it that we do that makes the solution seem to jump out once we get close? How then do we write a program capable of doing something we do when we're not even sure how we do it? No one said the program had to get the solution in the very same wey we did. And, of course, if we could get a program to solve the puzzle, it might help us to understand more fully what it was we did when we solved it.

If all that's a little confusing, it may be

because we have quickly, albelt via a trivial example, errived at the kinds of issues that are at the heart of much of the current Al research. Let's take a look at some products of Al research—some programs that, in the words of MIT's Marvin Minsky, "do things that would require intelligence if done by men." Actually, some of them only seem to require Intelligence at first.

Eliza

This "psychiatric interviewer" program (some versions are called Doctor), written by Joseph Welzenbaum, has been around for over 15 years. It is worth a little consideration, if for no other reason, because it has "fooled" some people. After an encounter with the progrem (difficult as it may be to believe), some people who had a sufficient willing suspension of disbelief or naivete were convinced the program had really understood them.

If you "play along", you can produce a fairly realistic dialogue with the program. For example (the program's lines are in Itelics):

Hello. Tell me your problem.
I don't want to.
Why do you suppose you don't want to?



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"SHRDLU understands questions and requests put to it in English."

I could never talk to my father.

Tell me more about your family.

None of them liked me.

Perhaps in your fantasies none of them liked you.

Of course, the progrem is not really capable of understanding. Compared to some other programs, it is a very unintelligent program. Eliza echieves its effects by the clever use of a few gimmicks. A more skeptical interviewee quickly reveels the program's weaknesses:

Go away.

I'm not sure I understand you.

I think you're coming apart.

Why do you suppose you think you're coming apart?

You ere coming apart.

Perhaps in your fantasies you are coming apart.

No. You are in reality.

Perhaps in your fantasies you are in reality.

This rather inane little exchange reveals Eliza's limited language handling capability.

Animal

A somewhat more interesting program, capable of learning es it is used is celled Animal. This is a game in which the program tries to guess the name of the animal chosen by the user. When it makes an incorrect guess, it asks for the name of the user's animal and some information about it. It stores this information and recalls it at appropriate times in subsequent games. In one version the program begins by asking "Does it have horns?" If the answer is yes, it guesses the animal is e buffalo. If the answer is no, it guesses a butterfly. After a few wrong guesses and accumulating information provided by the user, a dialogue with the program might look like this:

Does it have horns?

No.

Does it have a beak?

No.

Does it have four legs?

Yes.

Is it true that it can climb trees?

No.

Does it have a curly tail?

No.

Does it give milk?

Yes.

Is it a cow?

Yes.

Notice that the user-provided information is stored in "branches." The program will not ask about dogs or cows when the exchange is about an animal with horns.

Does it have horns?

Yes.

Does it live in the woods near water?

Is it true that it is smaller than a buffalo?

Does it live in high rocky places?

Yes.

Is it an ibex?

Yes.

SHRDLU

One of the most intriguing and significant AI programs was produced by Terry Winograd in the AI Lab at MIT. SHRDLU is capable of understanding questions and requests put to it in English; it is capable of giving English answers to questions and of performing requested tasks even if they require multiple operations. As if that were not enough, the program can understand what it has done and why it has done it, and it can give competent English descriptions of these.

SHRDLU functions in e limited domain called e "blocks world." This consists of a variety of variously-colored blocks, pyramids, boxes, and so forth. The program answers questions about the arrangement of those objects, provided the questions are precisely stated. If they are not, the program asks for a clarification. SHRDLU will perform requested rearrangements of the shapes and explain what intermediate action, not specifically requested, was performed.

Douglas Hofstadter, who provides en absolutely insightful treatment of Winograd's SHRDLU in Godel, Escher, Bach, seys that while "SHRDLU may not be isomorphic to what we do...the act of creating it and thinking about it offers tremendous insight into the way intelligence works."

Internist

The study of "expert systems" is leading some researchers to develop more practical programs. Internist, developed by Myers and Pople et the University of Pittsburgh, reproduces the special diagnostic skills of a doctor of internal medicine. The program collects data on a patient's symptoms, case history, test results, and so forth. Acting much like a human diagnostician, the program then decides which possibilities to delve into, asks specific questions about a possible illness and suggests a diagnosis.

The developers of Internist believe it will be ready for field testing at institutions

other than Pittsburgh by 1983.

More Roast Mules, Algorithms and Heuristics

Our discussion of how we might solve the puzzle presented at the beginning of this article exhibited two approaches to programming. The first is the usually straightforward method of writing the code for a given algorithm. In the case of our example, the algorithm might be:

- generate one combination of the 10 letters.
- check this with a standard English dictionery to see it it is a word.
 - if it is, stop.
- if not, go back to the first step and start another round

It wouldn't be hard to write a procedure to generate the permutetions, especially in a good Al language like Lisp. It wouldn't even be too difficult (just very boring) to give our progrem access to the words in a standard dictionary—all we really need would be the listings under A, E, L, M, O, R, S, T and U. Somewhere between the first and the 3,628,800th iteration, we would have our solution.

While this would get the job done, it would be neither elegent nor very satisfying. We might somehow feel uneasy about reproducing in so mechanical a fashion something we do in a very sophisticated manner. We might try to write a more sophieticated procedure, which could include various linguistic principles. Basically we would want to teach the computer some of our language—we would want the program to produce and evaluate syliables just as we do. We would went it to be able to combine these to form trial words just as we do. Using such principles or "rules of thumb" is an heuristic approach to our programming problem.

It is easy to see that the first two programs (Eliza and Animal) employ the straightforward algorithmic approach, while the latter two make use of heuristics. Actually, SHRDLU and Internist probably employ both approaches. Programming heuristics can give us a more sophisticated, more intelligent-appearing program.

Of course, to program in this way implies some understanding of the mental rules of thumb we use when solving our puzzle. This is what Hofstadter is referring to in his statement about SHRDLU.

Are Machinea and Programs Intelligent?

Al researchers for the most part are not

"... one theorem-proving program has correctly proved a theorem with a proof the author was unfamiliar with."

trying to produce mechanical brains. We are a great many years away from any such possibility. In fect, there does not seem to be any hard knowledge on how the brain interprets basic neural activity into "conscious thought." So even if we had the hardware ability readily available to construct a machine that could reproduce what the brain does in this interpretation, the levels of interpretation in the brain and in the machine would not necessarily be isomorphic-there would not have to be a one-toone correspondence between the levels of interpretation in the brain and those in the machine. While trying to construct such a machine could lead us to new insights about what happens in the brain when thought takes place, we are not on the verge of being replaced by mechanical thinkers.

In spite of the fact that algorithms have been written for activities such as juggling and bike riding, I don't think anyone has tried, in software, to get a TRS-80 to turn a somersault. Still, programs designed to do things that normally require human intelligence have produced some interesting and occasionally surprising results. For example, one theorem-proving program is known to have correctly proved a theorem with a proof the program's author was not familiar with. In e case such as this it is hard

to say whether the intelligence exhibited by the program was its own or merely a reflection of its author's intelligence.

Would our puzzle-solving program be intelligent if it solved the puzzle in a way even similar to our way of solving it?

The answer to this question as well as the puzzle itself is, in the over-used last words, left to the reader as an exercise.

Al Related Reading

If the topic of artificial intelligence is something you would like to enter more deeply into, here are some interesting and readable books on the subject:

Hofstadler, Douglas, Oodel, Escher, Bach, Gasic Books, New York, 1979
Winston, Patrick, Artificial Intelligence, Addison-Wesley, Reading, Mass 1977
Abelson, H. and di Sessa, A. Turtle Geometry, The MIT Press, Cambridge, Mass, 1981
Papert, Seymour, Mindstorins, Basic Books, New York, 1980.
Ringle, Martin (ed.) Philosophical Perspectives in Artificial Intelligence, Humanities Press, New York, 1979

Boden, Margaret, Artificial Intelligence and Natural Man, Basic Books, New York, 1977.

Kent, Ernest, The Brains of Men and Machines, Byte/McGraw Hill, New York, 1981.

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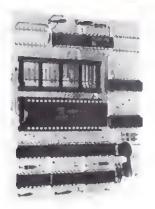


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A discussion of the Pulitzer Prize-winning book.

Godel, Escher, Bach

Godal, Eschar, Bach: An Eternel Goldan Braid Basic Books, Inc. Naw York, NY Hardcovar, 777 pp. \$20.50

by Nancy Robertson

Alan Turing, a mathematician and influential pioneer of computer science, wrote, "I believe that at the end of the century the use of words and general educated opinion will have altered so much that one will be able to speak of machines thinking without expecting to be contradicted."

Turing made that prediction over 30 years ago. Perhaps in two more decades it will be true. But in our time, the debate over the question, "Can machines think?" Is raging and emotional. It has been fanned by the uncanny growth in computer production, and aired in general interest publications such as the New York Times Sunday Magazine. Like the theory of evolution, the question threatens the ego of our species. Yet, artificial-intelligence research is undeniably a tool toward understanding human intelligence.

Douglas Hofstader, a young physicist and computer scientist, frames the questions of the artificial intelligence (Al) debate eloquently in Godel, Escher, Back: An Eternal Golden Braid (Basic Books, Inc., 1979, New York, NY). In 1980 the book won a Pulitzer, Later that year, it reached the New York Times best sellers list.

It is a deep and provocative volume that illustrates the infinite complexities of intelligence. Using the works of Kurt Godel, M.C. Escher and Johann Sebastian Bach, Hofstader identifies three vital characteristics of human intelligence; hierarchies, strange loops, and paradox. They can be interpreted as the three strands of the title's "eternal



M. C. Escher's Canon Crabs

€ 6EELDRECHT, Amsterdam VAGA, New York 1981 Collection Haags Gemeentehuseum

golden braid." The limited occurrence ut these qualities in our most recent and impressive computing achievements reflects on our limited understanding of human intelligence.

Artificial intelligence is not merely advanced computer science, but a compusite of studies. "In our century the time was ripe for computers—" the author writes, "computers beyond the wildest dreams of Pas-

cal, Leibniz, Babbage, or Lady Lovetace. In the 1930's and 1940's, the first 'giant electronic brains' were designed and built. They catalyzed the convergence of three previously desperate areas: the theory of axiomatic reasoning, the study of mechanical computation, and the psychology of intelligence."

It seems natural to consider the nature of human intelligence before mechanical

"It is a deep and provocative volume that illustrates the infinite complexities of intelligence."

computation. It is more familiar to us. Yet, it's obvious that a simple dictionary definition of intelligence or intellect is trivial.

Midway through the book, Hotstader writes, "Our confusion about who we are is certainly related to the fact that we consist of a large set of levels, and we use overlapping language to describe ourselves on all of those levels." Hofstader's discussion of those levels, beginning with Bach, Escher and Godel, is one of the books most profound statements.

While the choice of Godel, Escher and Bach at first appears incongruous, Hofstader presents their work as "shadows cast in different directions by some central essence." The opening chapter of the book simultaneously introduces these men and Hofstader's concept of levels of meaning

The author begins by considering Bach's *Musical Offering*. The title of the composition refers to the fact that it was dedicated, or offered, to Frederick the Great, who was the reigning king of Prussia.

Bach wrote an inscription on the original score, Regis Iussu Cantro Et Reliqua Canonica Arte Resoluta. (It translates to "At the King's Command, the Song and the Remainder Resolved with the Canonic Art.") The Initials form an acrostic, spelling the Italian word ricercar, which meant both "to seek" and "fugue." A canon, which is the musical form of most sections of the Musical Offering, is a strict single-theme fugue. There is also a great deal to seek in the Musical Offering. In this short example, Hotstader introduces the potential for multiple layers of meaning.

"The idea of a canon," Hofstader explains," is that one single theme is played against itself. This is done by having 'copies' of the theme played by the various participating voices." Fugues follow the same principles of composition, but are based on one or more themes. These themes may be varied in time or pitch. They may be inverted or reversed. For instance, what musicians commonly call a "crab canon" begins with a theme that is played backwards in its second and final rendition.

Hofstader uses the term "isomorphic" to describe the relationship of the variations to the original theme. In other words, the variations are altered forms of the original theme. It is possible to extrapolate a theme from any of its variations. The role of isomorphism in thought processes is stressed again and again throughout the book.

Hofstader wants us to recognize that the form or structure of our thoughts have im-

pticit meaning. The structure of the thoughts we iterate reveals something about the sublevel thoughts that build expression.

In the Musical Offering the Canon per Tonos has a significant structure. In each expression of the theme, Bach modulates the key upward. For instance, the first statement of the melody and accompanying voices begins in C minor, but the resolution is in D minor. Normally, variations end or "resolve" in the same key that they begin. Opening in D minor, the second statement of the Canon per Tonos theme resolves in yet a higher key. The pattern continues to spiral through six modulations. Bach has broken down our normal expectations, yet surprisingly brings the piece back to its original key in the final modulation.

A canon or fugue is clearly a hierarchical system. The rules of composition and the themes to which they are applied produce distinct patterns and levels within the structure.

The Canon per Tonos takes us a step farther into Hofstader's theory. This particular canon is an example of a strange loop. "The 'Strange Loop' phenomenon occurs whenever, by moving upwards (or downwards) through the levels of some hierarchical system, we unexpectedly find ourselves right back where we started."

This concept leads us smoothly to M.C. Escher, a Twentieth-century lithographer and print master who represented his fascination with strange loops visually. Escher is known for prints such as Waterfall and Drawing Hands. In Waterfall, water travels upward through a series of three sluices, drops from a waterfall, and begins its defiance of gravity all over again in the same sluiceway. Drawing Hands depicts a sheet of paper on a drawing board. The left hand, which is drawn on the paper, is drawing a right hand, which is drawing the left hand.

"The viewer cannot help getting caught up in Escher's implied chain of levels, in which, for any one level, there is always another level above it of greater 'reality,' and likewise, there is always a level below, 'more imaginary' than it is," Hofstader writes to Drawing Hands there is a level of "greater reality" just beyond the print: Escher's hand has drawn the hands that

Eta Oin: Can a pyramid support a pyramid? SHRDLU: I DON'T KNOW.

Dr. Tony Earrwig: The question makes sense, but there is no example in the scene. SHRDLU has no way of looking into the details of its programs, even though these ultimately define its capabilities.

Eta Oin: Stack up two pyramids.

SHRDLU: I CAN'T.

Dr. Tony Earrwig: SHRDLU tries and fails.

Eta Oin: The blue pyramid is mine.

SHROLU: I UNDERSTAND.

Dr. Tony Earrwig: All of the information about colors, shapes, sizes and locations of the objects is known to SHRDLU initially. Possession is left as an unknown property of objects about which it can be told. It stores this information in its data base.

Eta Oin: I own all blocks which are not red, but I don't own anything which supports a pyramid.

SHRDLU: I UNDERSTAND.

Dr. Tony Earrwig: The result of understanding these sentences is the creation of new procedures within SHRDLU for deducing whether you own samething. Eta Oin: Do I own the box?

SHRDLU: NO.

Or. Tony Earrwig: The box supports whatever it contains, including a pyramid. Eta Oin: Do I own anything in the box?

SHROLU: YES, TWO THINGS: THE BLUE BLOCK AND THE BLUE PYRAMID.

Example 1

"So far in the development of computer science, conscious self-reference, the recognition of paradox, and understanding the concept of infinity are all elusive."

drew each other.

The print itself is charecterized as a twostep etrange loop: The right hand drews the left; and the left hand drews the right. The strange loop of *Drawing Hands* is represented in Fig. 1.

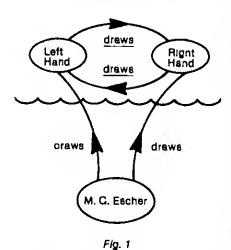
Hofstader's term "strange loop" is a finite representation of Infinity. "in... strange loops... there is a conflict between the finite and the infinite, and hence a strong sense of paradox."

While Hotstader sees Eschar's prints as "visual analogues to the cenone of Bach," tha peradox embedded in them leads to the study of Godel. Kurt Godel was a German mathematician who published a treatise on mathematicial reasoning in 1931. The paper showed "that no axiomatic system whatsoever could produce all number-theoretical truthe, unless it were an inconsistent system!"

Using the strict rules of formel mathematical system to generate and prove theorems of number theory, Godal discovered a true theorem that could not be proven. The discovery of this paradox lead to his incompleteness Theorem and treatise. The validity of his argument threatened the foundations of mathematics, which is dedicated to the eradication of incongruity.

Outside of mathematics, peradox has been a recognized characteristic of human thought since ancient times. Epimenides was a netive of Crete who is credited with "one immortal statement: 'All Cretans are lisrs.' "Was Epimenides felling the truth?

The Epimenides peredox, or "lier's paradox," is a one-step strenge loop. A two-step strange loop expressing a similar paradox could be:



"The following sentence is false.
The preceding sentence is true."

This two-step loop is closer to the heart of Godel's Theorem.

Called TNT for Typographical Number Theory, Godel constructed a formal methematical system that could write self-referential statements about natural numbers. Applying self-reference to numbers was brilliant, regardless of the additional discovery of paradox. Self-reference was a recognized characteristic of human dialogue, of literature and art—but not at all characteristic of our traditional percaption of mathematics.

In TNT language can be represented by symbols, which in turn can be represented by numbers. For instance, the English language version of the first axiom of TNT is, "For all verlablas a there does not exist a successor of a that is equal to zero." Symbolically, this statement can be represented by: a: Sa = 0. The numeric sequence which expresses the same axiom is: 666,262,636,123,262,111,666.

Using TNT to generate and prove theorems of number theory, Godel eventually derived Theorem G. Hoistader roughly translates this to "G is not a theorem of TNT." In a two-step strange loop, it might be represented as follows:

G is a true statement of number theory.
G cannot be proven.

While the Epimenides paradox rests on the fact that the statement is neither true nor false, Godel's Theorem G is true, but defies proof.

The Important thing to grasp about Godel's work is that paredox and self-reference are not limited to language, music and art—peredox and self-reference are found in number relations. Both paredox and self-reference are universal characteristics of human thought. Godel's work reinforces our knowledge that numbers, like words, are symbolic (or isomorphic) representations of ideas.

So far in the development of computer science, conscious self-reference, the recognition of paredox, and understanding the concept of infinity ere all elusive. Yet computers, like humane, base their thought operations on hierarchical sytems. Between computer hardware—memory registers, CPUs I/O devices and circuitry—and high-level languages such as Liep there are

Intelligent programs	
Embedded Pattern Matcher	
LISP	
Compiler or Interpreter	
Machine Instructions	
Registers and Data Paths	
Flip-Flops and Gates	
Trensistore	

Fig. 2

several functions. There is a machine language, assemblers, assembly code, interpreters, low-level language, etc. Fig. 2 is a diagram, taken from Godel, Escher, Bach, representing the hierarchy of intelligence in a computer.

Hofstader believes that there are human processes that could be delineated that serve the same functions. On the lowest level, he compares herdwara and the brain as an organ. For an example of a higher level analogy, take a computer operating system. "It is virtually certain that there are somewhat perallel things which take place in the brain: hendling of many stimuli at the same time; decisions of what should have priority over what and for how long; instantaneous interrupts caused by emergencies or other unexpected occurrences..."

Yet computers have seldom demonstrated understanding, self-swereness or creativity. A computer that generates halku or music from a random mixture of programmed phrases is not creative any more than a celculator is creative. The computer does not intend the resulting lines and melodles to have meening. It does not understand the explicit definition of the sentence it generates. It does not appreciate the tones of the musical themes it combines. Hofstader writes that:

An intelligent program would presumably be one which is versatile enough to solve problems of many different sorts. It would learn to do each different one and would accumulate exeprience in doing so. It would be able to work within that set of rules and yet, also, at appropriate moments, to step back and make a judgement about whether working within that set of rules is likely to be profitable in terms of some overall set of goals which it has. It would be able to choose to stop working within a given framework, If need be, and to create a new framework of rules within which to work for a while.

This is the sort of intelligence Godel used

"Yet computers, like humans, base their thought operations on hierarchical systems."

in discovering hie incompleteness Theorem, that Eacher used in most of his art, and that Bach exemplified in the Canon per Tonos.

Hofstader believes that the current inebility of programming and computer science to achieve such program reflects our limited understending of human thought. He believes "One key for under-

standing end creation of intelligence lies in blocks. Hofstader writes that the progrem the constent development and refinement of the languages."

He argues that Terry Winograd's Al progrem SHRDLU had demonstrated a degree of understanding in a machine. The progrem, which was written while Winograd was e greduate student at MIT, converses with humans to menipulete imaginery was designed to:

- Understend questions in English ebout the situetion;
- Give enswers in English to questions about the altuation;
- Understand requests in English to manipulate the blocks;
- Breek down each request into a sequence of operationalit could do:
- Understend what It had done end for whet reasons:
- Describe its actions and their reesons, in English.

Like Hotsteder, Winograd emphaelzee the importance of the tangled hierarchy of . language. He modeled SHRDLU on his view of human thought and human lenguage. Rather than sepereting the various functions of the progrem into modules, he intertwined them. The program is so convoluted that other programmere initially thought it wes abourd. Yet, the achievements of SHRDLU ere impressive.

Example 1 is a segment of a transcribed converstaion between SHRDLU end a visitor. (The words of Dr. Earrwig ere actually Winograd's. Eta Oin is a fictional name of a real visitor.) in this short passage, SHRDLU demonstrates an ability to learn concepts.

In en article about SHRDLU Winograd

One of the basic viewpoints underlying the model is that all language use can be thought of as a way of activating procedures within the hearer. We can think of any utterance as a program-one that indirectly causes a set of operations to be carried out within the hearer's cognitive system. This "program writing" is indirect in the sense that we are dealing with an intalligent interpreter, who may take a set of actions which are quite different from those the speaker intended. The exact form is determined by his knowledge of the world, his expectations about the person talking to him, etc. In this program we have a simple version of this process of interpretation as it takes place in the robot. Each sentence Interpreted by the robot is converted to a set of instructions in Planner (an Al computer language). The program that is created is than executed to achieve the desired affect.

One of Winograd's statements is especially important, "We can think of any utterence as a program—one that indirectly causes a set of operations to be carried out within the heerer's cognitive system." These "progreme" end "sets of operatione" are the sorts of levels Hofstader wants us to recognize in our own thinking.

Hofateder must strees his point by exem-

Continued on page 192

The 'Eternal Golden Braid' A Study of Artificial Intelligence

by Nency Robertson

At first glance, the response to Godel, Escher, Bach seems as incongruous as the "eterne) golden breid" that weaves the genlus of these three men together in a study of artificial intelligence. In 1980 Douglee Hofsteder's opus, a book of over 700 pages in Basic Book'e hardbound edition, won the Pulltzer Prize for general nonfiction.

Martin Gerdner, who had reviewed the book for Scientific American wrote, "Every few decedes an unknown author brings out e book of such depth, clarity, range, wit, beeuty and originality that it is recognized et once es e major literary event." So it was for Godel, Escher, Bach.

The manuecript fell into the hands of Martin Keesler, president of Basic Books, New York, NY, when a friend of his who had hoped to publish the volume through e university prees despaired of the lerge task. When the enormous bundle of manuscript and diagrams arrived in the mail, Kessier's first reaction wes "a sinking feeling, but then I took it home and began reading it-end i got hooked, at first by the puzzlee" Hofstader used to iliustrate

Keasier decided to go shead with publication, eithough the potential production cost appeared prohibitive. "It looked like we'd have to cherge \$28 a copy to make our money back. The negging question wae who would buy the book at thet price. While Interest in the manuacript began to

show that the book would probably ettract a wider reederehip then the publishers originally anticipeted, production problems continued. Finally, errangements were made with Hofeteder to typeset the volume himself on a computer.

After the hardback edition came out, Vintege, a subsidiary of Random House, negotiated for the rights to the paperback edition. From October, 1980, to March, 1981, a tome considering the cherecteristics of human thought, the intelligence of three creative geniuses end the ramifications of artificial intelligence, Godel, Escher, Bach bobbed up and down on the New York Times' list of best selling trade books. Its subject and its depth made its appearance on the list unique.

Hofstader, who was born in New York City and raised in Celifornia, is temporarily living in Berkeley, CA, and continuing his research. He is uncomfortable with the notorlety the book has brought him-the phone calls from strangers and the hundreds of letters. "Different people deal with feme in different weys," he said. Although he is eppreciative of the interest in the book, he feels it has the strength to "stand on its own." So fer, he hes tried to keep up with the correspondence that has resulted from the publication of Godel, Escher, Bach. Recently he responded to over 400 letters from readers, but his energy is waning. He continues the eternal quest implied by his book.■

On the cutting edge of research.

Artificial Intelligence at M.I.T.

G. Michael Vose 80 Microcomputing Technical Staff

f man's intelligence is truly natural intelligence, then any intelligence simulated by a machine would be artifical—or possibly unnatural. This intelligence would be hard to define, at least in part because intelligence itself is hard to define. This has been one of the findings of the Artificial Intelligence Leboratory at the Massachusetts institute of Technology in Cembridge, Massachusetts.

Founded in the early 1960s by Mervin Minsky, M.I.T's Al Leb has grown to include 10 full-time faculty members, a research end support staff of 35 and 30 graduate students. These people are engaged in theoretical research as well as specific projects for concerns such as the Defense Advanced Research Projects Agency, the Air Force Office of Sponsored Research, the National Science Foundation, the Xerox Corporetion end others.

The primary goal of the M.I.T. Al Lab, according to its Director Dr. Patrick Winston, is to "understand how computers can be made to exhibit intelligence." The two major espects of this search include development of a more thorough understanding of

human intelligence, and finding ways to make computers more useful. Recantly, the Al Lab has channeled its research energies into Imege understending, studies of natural vision, robotics, learning from experience and language comprehension, problem-solving techniques of experts, the computing environment and education.

Education Projects

The education projects ere among the Lab'e most celebreted and are led by Protessor Samuel Papert. Professor Papert directs the Logo Group, a group which attempts to apply the theoretical findings of Al research to education. The Group has been instrumental in the development of the Logo language. Logo is designed to allow children to learn through their involvement in "teaching" the computer. Recent work in the Group has involved the study of spetial reasoning.

Dr. Berthold K.P. Horn directs the imageunderstanding research team. They have developed albedo maps, maps from photographs which have had ground slope and sun position shadows removed so that the intensity of the image is solely a function of ground cover. This research focuses on shading and surface characteristics.

Along with the topic of image understanding, the Al Lab conducts research on natural vision. This effort is led by Professor Shimon Ullman and concentrates on understanding the process whereby the retina of the human eye distinguishes between light sources of differing intensity.

Obviously, vision and Image-understanding research will have an application someday in enother of the Lab's research areas, robotics. The team working on the Robotics projects includes Dr. J. Michael Brady, Dr. John M. Hollerbach and Professor Tomas Lozano-Perez. The primary thrust of current research is the development of a high-level menipulator language.

The Al Lab's overall Director, Patrick Winston, heads the theory of reasoning by enalogy project; Professor Marvin Minsky, the Lab's most well-known member outside academic circles, continues his work on the "society of minds" theory. This is a theory which postulates that intelligence is the result of the interplay among groups of related individual concepts or processes. Professor Richard Greenblatt continues his work with Lisp, a character-manipulation language that he developed initially several years ago.

In a recent interview with 80 Microcomputing, Dr. Winston addressed the Issue of whether or not ertificial Intelligence research will develop mechines so powerful that society may become over-dependent on them. "In the first place, America and Europe are already overly dependent on machines. For example, without farm mechinery most of the industrialized West would starve to death. Secondly, one of the major goals of Ai research is the development of computers that explain what they are doing and how they are doing it. In this way, Al may help us understand ourselves better."

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Master Mind— An Intelligent Program

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ave you ever encountered the mysterious phrase "artificial intelligence" while flipping through the pages of your favorite microcomputing magazine? Did you find yourself asking, "What's artificial intel-

ligence and how can I use it?"

Artificial intelligence (AI) is a computer system which exhibits behavior that is called intelligent behavior when we observe it in human beings. The most common intelligence displayed by AI systems are the abilities of problem solving, learning and pattern recognition.

Combining these ingredients Al systems have been designed to solve many varied and complex problems, such as investment

analysis, proving theorems, and robot guidance system design. All work has also taught computers to play chess.

I first applied Artificial Intelligence techniques to a Master Mind program. I had written a program that allowed a person to play a solo version of Master Mind. In the solo version the computer randomly produced codes for the player to guess. The computer evaluated each of the player's guesses until the code had been broken.

This solo version grew tiresome. To modify this program, so that both the computer and player could take turns making and breaking codes, required artificial intelligence techniques. Although the new version of Master Mind is not as sophisticated as a cybernetic investment system, it requires the computer to exhibit intelligent behavior. The computer learns how to duplicate the thought processes necessary to break codes.

Position Position Position 1 2 3 4 Code Maker's Code blue red red yellow Code Breaker's guess red blue green yellow Example 1.

Evaluation Pattern

Number of blacks + whites = 0 Number of blacks = 0, number of whites greater than 0

Number of blacks + whites = 4

Number of blacks = 4

Action

Do not use any of the numbers in this guess in future guesses

The numbers in each position of this guess cannot appear in the same position in future guesses.

Only the numbers in the guess are in the code. Do not consider numbers that are not in this guess in future guesses. The goal state has been reached and the code broken.

Example 2. Pattern recognition operations.

If this guess were the code then the evaluation of 1111 would be 1112 three blacks and zero whites 1113 three blacks and zero whites 1114 three blacks and zero whites 1115 three blacks and zero whites 1116 three blacks and zero whites 1116 three blacks and zero whites 1116 three blacks and zero whites

Master Mind

If you are not familiar with Master Mind, it is a game of deductive logic, manufactured by Invicta Plastics, Ltd. Played by two people, each takes turns assuming the roles of code maker and code breaker.

At the beginning of play, the code maker constructs a code by selecting an ordered combination of four colored pegs from six sets of pegs, each of a different color. The code breaker cannot see the arrangement. He attempts to duplicate the order and color of the pegs in the code by placing his guesses on a board, one at a time. After each guess (which consists of placing four colored pegs on the board) the code maker evaluates the code breaker's guess. The code breaker uses these evaluations to try to guess the code.

The code maker evaluates each guess by giving the code breaker one black peg for every peg in the guess that is the correct color and position. One white peg is given

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Documentation (# of pages)



"Master Mind is a game of deductive logic, played by two people. Each takes turns...as code maker and code breaker."

tor every peg that is the right color, but in the wrong position. The white and black pegs, however, do not correspond positionally to specific pegs in the guess. See Example 1.

The code maker evaluates the guess in Example 1 by giving the code breaker one black peg and two white pegs. If this were the first guess, the code breaker would have no idea which peg was the right color and in the right position (the yellow peg) and which two pegs were the correct color but in the wrong positions (the red and blue pegs).

The code maker receives one point for each guess the code breaker makes. A turn is completed after each player has been both the code maker and code breaker. The player with the highest score wins.

Meens-ends Analysis

The most difficult part of teaching a computer to play Master Mind is teaching it to break codes. But, breaking a code can be compared to solving a problem.

We can employ one of the Al techniques for problem solving. I decided to use the Means-ends Analysis devised by Newell and Simon.

In Means-ends Analysis the ends represents the solution to a given problem and is referred to as the "goal state." The "current state" describes how close the problem solver is to the goal state and represents all of the information accumulated in the search for the solution.

Fundamental to Means-ends Analysis is the concept that there is a measurable difference between the current-state and the goal-state. This difference may be reduced by a repeated application of certain operations to previously acquired information. This represents the "means" of solving the problem.

In Master Mind the goal state is guessing the code. The current state is all of the information the code breaker has accumulated toward the goal. Initially, the current state consists solely of the code breaker's knowledge of the rules of Master Mind.

The difference between the goal state and the current state is the maximum number of guesses the code breaker would have to make to arrive at the code. Because the code could consist of four pegs and each peg could be selected from one of six different colors, it would be possible for the code breaker to make 1,296 ($6 \times 6 \times 6 \times 6$) guesses before duplicating the code.

To reduce this difference, the first move is to make a guess.

Because the computer will be competing with a person, and because a person can usually guess the code after four to twelve guesses, we must discover additional operations that may be performed so the code can be broken after four to twelve guesses.

Verbel Protocol end Problem-Behavior Graphs

"Verbal Protocol" is another technique of Artificial Intelligence which is used to discover what mental operations are performed by people when they solve a particular problem. To record these processes, the problem solver is asked to think out loud as he attempts to find the solution. The verbalized thoughts are written down. The documentation is reterred to as verbal protocol. Verbal protocol is analyzed to discover operations that the problem solver performs on acquired information to find the solution.

The analysis of the verbal protocol is simplified through the use of problem-behavior graphs which are representations of the verbal protocol.

To explain how verbal protocol and problem-behavior graphs can be used, let's review an example of a code breaker taking one guess at the code maker's code. To simplify the example, rather than using six colors to form the code, we will use the numbers one through six.

Let's assume that the code is 4326. We already know that the code breaker must first make a guess to begin reducing the difference between the current state and the goal state.

The verbal protocol of the first guess would go something like this:

"Let's see, I'd better make my first guess. What should I start with? Oh, I know. Why don't I start with

The code maker would then evaluate the guess as zero blacks and zero whites.

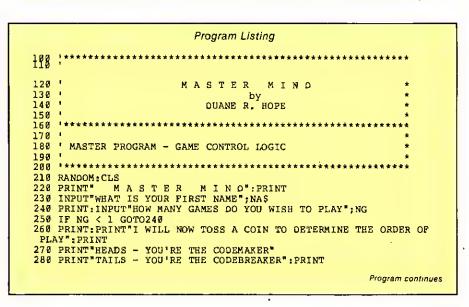
The code breaker would continue thinking, "No blacks and no whites. That means the code doesn't contain any ones"

To draw the problem-behavior graph, represent the current state of knowledge with a rectangle. An operation leading us to a new state of knowledge will be represented by an arrow, See the problem-behavior graphs in Fig. 1.

Analyzing the graph, you see that the first operation is making the guess 1111. This leads us from the first state of knowledge where we knew only the rules of the game, to the second state of knowledge where we learn that the guess is evaluated by zero blacks and zero whites. The first operation has reduced the difference between the first state of knowledge and the goal-state from 1,296 possible guesses to 1,295.

Graph (b) of Fig. 1 shows that the second operation, "If B+W=0, the numbers in this guess can't be in the code," takes us from the second state of knowledge to the third: The code can't contain any ones. This second operation has further reduced the difference between the current state of knowledge and the goal state to 625 possibilities ($5 \times 5 \times 5 \times 5$).

To further reduce the difference between a current state of knowledge and the goal



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"Pattern recognition is an AI technique used for converting information into action."

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Program continued
     290 FOR I=1 TO 2500:NEXT I
    300 CT = RND(2)
310 IF CT = 1 M1$="HEADS":M2$="CODEMAKER"
320 IF CT = 2 M1$="TAILS":M2$="CODEBREAKER"
330 PRINT"THE COIN CAME OUT ";M1$;" SO YOU WILL BE THE ";M2$:PRI
    340 FOR I=1 TO 2500:NEXT I
    350 GC=0:PC=0:PP=0
    350 GC=0:PC=0:PP=0
360 IF CT = 1 GOSUB560 ELSE GOSUB960
370 IF CT = 1 GOSUB960 ELSE GOSUB560
380 IF GC = 0 GA$="GAME" ELSE GA$="GAMES"
390 PRINT"AFTER";GC+1;GA$; "THE SCORE 1S:"
400 PRINT" COMPUTER";PC
420 FOR I=1 TO 2500:NEXT I
430 GC = GC + 1
440 IF GC < NG GOTO360
450 M1$="IT'S A TIE"
460 PRINT
    460 PRINT
    470 IF PC > PP THEN M1$="I WON"
480 IF PC < PP THEN M1$="YOU WON"
     490 PRINT M1$
    500 PRINT: INPUT WOULD YOU LIKE TO PLAY ANOTHER GAME ", M1$ 510 IF LEFT$ (M1$,1) = "Y" GOTO240 520 PRINT: PRINT "THANK YOU FOR PLAYING, ", NA$
     530 END
     540 **********************
     550 1
     560 ' THIS IS THE CODE MAKER ROUTINE
     570
     580 ****
    590 PRINT:PRINT*IT'S YOUR TURN TO MAKE A CODE":PRINT
600 INPUT"ENTER 4 DIGIT CODE FOR ME TO GUESS";CO$:IF LEN(CO$) <>
      4 GOTO600
    610 NUM$=CO$:GOSUB1290
     620 IF ER<>0 GOTO600
    630 RESTORE
    640 FOR R=1 TO 6
650 FOR C=1 TO 4
     660 READ PO(R,C)
     670 NEXT C.R
     680 C1=1:C2=1:C3=1:C4=0:GU=0
     690 GU=GU+1
    700 IF GU=1 THEN POR I=1 TO 4:C(I)=RND(6):NEXT I
710 IF GU=2 THEN C(1)=C1:C(2)=C2:C(3)=C3:C(4)=C4
720 IF GU>2 THEN FOR I=1 TO 4:C(I)=GT(GU-1,I):NEXT I
730 IF GU>1 GOSUB1690
740 TRYS=""
     750 FOR I=1 TO 4:TRYS=TRYS+RIGHTS(STRS(C(I)),1):NEXT I
760 PRINT"PLEASE EVALUATE TRY NUMBER";GU; " ";TRYS
     760 PRINT"PLEASE EVALUATE TRY NUMBER"; GU;
     770 INPUT" ENTER W";BB
780 INPUT" ENTER W";WW
790 FOR I=lTO4:GT(GU,I)=C(I):NEXT I:GT(GU,5)=BB:GT(GU,6)=WW
     800 NUMS=COS:GOSUB1290
     810 FOR I=1 TO 4:C(I)=T(I):NEXT I
     820 NUMS=TRYS:GOSUB1290
830 GOSUB1490 'EVALUATE GUESS
     840 FOR I=1 TO 4: T(I)=C(I):NEXT I
850 IF BB=B AND WW=W GOTO880
     860 PRINT"YOUR EVALUATION SHOULD HAVE BEEN B =";B; " W =";W
     870 GT(GU,5)=B:GT(GU,6)=W
     880 IF B=4 THEN PP=PP+GU; PRINT"I GOT IT !!": RETURN 890 IF B+W=4 GOSUB1840 900 IF B+W=0 GOSUB1990
     910 IF B=0 AND W<>0 GOSUB2110
     920 PRINT"QUIET, I'M THINKING"
           GOTO6 90
     930
     940 DATA 1,1,1,1,2,2,2,2,3,3,3,4,4,4,4,5,5,5,5,6,6,6,6
     950 RETURN
     960
     970
                                                                                                  Program continues
```

state, I recorded verbal protocol as I attempted to break several codes, and constructed problem-behavior graphs. When I analyzed the graphs, I discovered that the operations I performed could be grouped into two categories: "pattern recognition" and "learning."

Pattern Recognition

Pattern recognition is an AI technique used for converting information into action. In pattern recognition there is a one-to-one correspondence between a particular information pattern and an appropriate course of action. The list In Example 2 comprises the pattern recognition operations I discovered.

In certain cases the use of pattern recognition mechanisms will help reduce the difference between the current state and the goal state. In other cases, pattern recognition must be augmented by the learning process.

Learning

The learning process is an AI technique that gradually modifies a programmed decision system to improve performance. Modifications are made from performance evaluations of previously made decisions.

For example, each guess that the code breaker makes, along with the corresponding evaluation, is saved. Prior to making each succeeding guess, previous guesses are reevaluated in light of the next guess you are contemplating. If the evaluation of each preceding guess is unchanged, then the prospective guess could be the code—and the guess will be made. On the other hand, if any of the reevaluations have changed since the original evaluations, then the prospective guess is discarded. This is the learning process.

Assume that the code is 4316 and that the code breaker's first guess is 1111. The code breaker, then, would receive an evaluation of one black and zero whites. No action would be performed as a result of this evaluation; the difference between the current state and goal state is only reduced by one.

However, by using the learning processes, we can reduce the difference further. Eliminate all possible guesses that would not result in one black and zero whites. See Example 3.

Since the code produced an evaluation for the guess 1111 of one black and zero whites, then none of the guesses in Example 3 could be the code because when they

1

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"In completing my analysis I realized it would be necessary to generate each of 1,296 possible guesses."

are substituted for the code they do not produce the original evaluation. In this example, there would only be 500 guesses that would produce evaluations of one black and zero whites.

Completing the Analysis

In completing my analysis of the problem-behavior graph, I realized that it would be necessary to develop a procedure for generating each of the 1,296 possible guesses—otherwise the computer would never be able to make any guesses. In addition, this generator would have to produce each guess only once.

The guess generator would also have to be designed so that the operations resulting from pattern recognition could be performed. To accomplish this, I used the possibility table shown in Fig. 2.

Each of the possible 1,296 guesses can be generated from this table. Initially the number used in positions W, X, Y and Z is set to a one. Then, to generate succeeding guesses, the right most position, position Z, varies from one to six. After the first six generations (1111, 1112, 1113, 1114, 1115, 1116), position Z is set to one again, and the next position to the left, position Y, is set to a two.

	State 1		State 2
		Make guess	Black = 0
(a)	(1296	1111	White = 0
	possibilities)		(1295
			possibilities)
	State 2		State 3
	Black = 0	If $8 + W = 0$	The code
(b)	White = 0	The	
		numbers	doesn't have
	(1295	in this guess	any ones.
	possibilities)	can't be in	(625
		the code.	possibilities)

Number to use	Posit	оп	in ç	บอร
	W	х	Υ	Z
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6

```
Program continued
 980
       ' THIS IS THE CODE BREAKER ROUTINE
 990
 1000 **************
 1010 PRINT:PRINT"NOW IT'S MY TURN TO MAKE A CODE"
1020 FOR I=1 TO 2500:NEXT I
1030 PRINT:PRINT"O.K., I'VE GOT IT NOW. TAKE YOUR FIRST GUESS"
 1040 PRINT
 1050 NO=0
 1060 FOR I=1 TO 4:C(I)=RND(6):NEXT I
 1070 INPUT ENTER YOUR GUESS (4 DIGITS) "; TRY$: IF LEN(TRY$) <> 4 GOT
 01070
 1000 NUMS=TRYS:GOSUB1290
 1090 IF ER<>0 GOTO1070
 1100 GOSUB1490 ' EVALUATE GUESS
 1110 NO=NO+1
 1120 PRINT"TRY NUMBER"; NO; " B =";B; " W =";W
 1130 IF B <> 4 GOTO1070
      PRINT"YOU
 1140
                   GOT IT 111'
 1150
      PC=PC+NO
 1160 RETURN
 1170
 1100
         ROUTINE TO PUT 4 DIGIT STRING NUMBER INTO ARRAY T(I)
 1190
 1200
 1210
            INPUT : NUM$-4 DIGIT STRING TO CONVERT
            OUTPUT: T(I) -ARRAY CONTAINING NUMERIC EQUIVALENT OF NUM$
 1220
 1230
                         -ERROR CODE
0 = NO ERROR
 1240
 1250
 1260
1270
                             1 = NO, < 1 OR > 6 ENCOUNTERED IN
                                 NUMS
 1280
 1290
 1300 ER=0
      FOR I=1 TO 4
 1310
      T(I) = VAL(MIDS(NUMS,I,1))
IF T(I) < 1 OR T(I) > 6 THEN ER=1
 1320
 1330
 1340
      NEXT I
 1350 RETURN
 1360
 1370
 1380
         ROUTINE TO EVALUATE CODEBREAKER'S GUESS
 1399
            1400
 1410
 1420
 1430
            OUTPUT: B
                          -NUMBER OF RIGHT NUMBERS IN RIGHT
 1440
                           POSITION
                          -NUMBER OF RIGHT NUMBERS IN WRONG
 1450
 1460
                            POSITION
 1470
                      T(I)-CONTENTS DESTROYED
 1400
 1490
 1500 B=0:W=0
 1510 FOR I=1 TO 4:W(I)=C(I):NEXT I
 1520 FOR I=1 TO 4
 1530 IF W(I) <> T(I) GOTO1550
 1540 W(I) = -1:T(I) = -2:B=B+1
1550 NEXT I
 1560 FOR I=1 TO 4
1570 FOR J=1 TO 4
 1580 IF T(I) <>W(J) GOTO1600
 1590 W(J) = -1:W=W+1:GOTO1610
1600 NEXT J
 1610 NEXT I
 1620 RETURN
 1630
 1640
 1650
         ROUTINE TO DETERMINE CODEBREAKER'S NEXT GUESS
 1660
 1670
            OUTPUT: C(I) - NEXT GUESE
                                                             Program continues
```

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"You should be able to apply these AI techniques to other situations to solve problems or make decisions."

```
Program continued
  1680
        ********
  1690
  1700 GOSUB2220 ' GET NEXT ENTRY FROM POSSIBILITY TABLE
  1710 FOR L=1 TO GU-1
1720 FOR J=1 TO 4
  1730 T(J)=GT(L,J)
  1740 NEXT J
  1750 GOSUB1490 ' EVALUATE OLD GUESS USING NEW GUESS AS CODE
  1760 IF GT(L,5) = B AND GT(L,6) = W GOTO1700
  1770 GOTO1700
  1700 NEXT L
  1790 RETURN
  1000
  1010
          ROUTINE TO ELIMINATE ALL NUMBERS IN POSSIBILITY TABLE
  1820
          EXCEPT THOSE IN THIS GUESS. THIS ROUTINE IS ENTERED WHEN EVALUATION OF LAST GUESS IS: B+W = 4
  1830
  1848
  1859
  1860
  1878 FOR I=1 TO 6: EL(I)=I:NEXT I
1888 FOR I=1 TO 4
  1090 EL(GT(GU,I))=0
  1900 NEXT I
  1910 FOR I=1 TO 6
  1920
        IF EL(I) <> \emptyset THEN PO(I,1) = \emptyset: PO(I,2) = \emptyset: PO(I,3) = \emptyset: PO(I,4) = \emptyset
  1930
        NEXT
  1940
        RETURN
  1950
  1960
  1970
          ROUTINE TO ELIMINATE ALL NUMBERS IN POSSIBILITY TABLE
  1980
          THAT OCCUR IN THIS GUESS. THIS ROUTINE IS ENTERED
  1990
          WHEN EVALUATION OF LAST GUESS IS : B+W = 0
   2000
   2010
  2020 FOR I=1 TO 4
2030 FOR J=1 TO 4
  2040 PO(GT(GU,I),J)=0
  2050 NEXT J,I
  2060 RETURN 2070 "********************
  2070
   2000
          ROUTINE TO ELIMINATE THIS GUESS FROM POSSIBILITY TABLE.*
   2090
   2100
          THIS ROUTINE IS ENTERED WHEN EVALUATION OF LAST GUESS
   2110
          IS: B=0 W<>0
   2120
   2130
   2140 FOR I=1 TO 4
        PO(GT(GU,I),I) = \emptyset
   2150
   2160 NEXT I
   2170
        RETURN
   2188
   219A
   2200
          ROUTINE TO EXTRACT NEXT ENTRY FROM POSSIBILITY TABLE
   2210
   2220
   2230 GOTO2360
   2240
        IF PO(C1,1) <> 0 THEN C(1) = PO(C1,1) : GOTO2280
   2250 C1=C1+1
   2260 IF C1<7 GOTO2240
   2270 PRINT"ERROR IN POSSIBILITY TABLE": END
   2200 IF PO(C2,2) <>0 THEN C(2) =PO(C2,2):GOTO2320
   2290 C2=C2+1
   2300 IF C2<7 GOTO2200
   2310 C2=1:GOTO2250
   2320 IF PO(C3,3)<>0 THEN C(3)=PO(C3,3):GOTO2360
   2330 C3=C3+1
   2340 IF C3<7 GOTO2320
   2350 C3=1:GOTO2290
   2360 C4=C4+1
   2370 IF C4 < 7 GOTO2390
   2300 C4=0:GOTO2330
   2390 IF PO(C4,4)=0 GOTO2360
   2400 C(4)=PO(C4,4)
   2410 RETURN
```

Whenever the evaluation is zero blacks and zero whites, each number in the guess can be deleted from each position of the possibility table, by setting its relative position to zero. A guess that has one or more of its positions equal to zero can be discarded.

The Problem-Solving Model

The operations discovered from analyzing the problem behavior graphs can be assembled into a problem-solving model. Fig. 3 shows this model.

The model begins with generating a guess (step 1) that does not contradict information from previous evaluations (step 2). If this guess contradicts previous evaluations, it is discarded and another guess is generated. A guess that is consistant with information from evaluations of previous guesses is made in step 3.

After feedback is received form the code maker in step 4, the evaluation is checked by the pattern recognition mechanism in step 5 to determine if any numbers should be eliminated from the possibility table. If the evaluation is four blacks (step 6), the code has been broken and the problem solved. If the code has not been broken, the model returns to step 1 and the operations are repeated.

The program listing will help you see how the model actually works. You should be able to apply some of these AI techniques to other situations requiring the computer to solve problems or make decisions

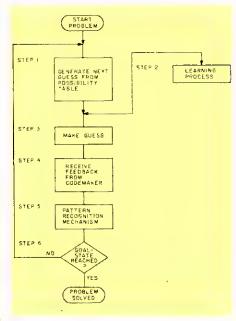


Fig. 3. Problem-solving Model

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Artificial Intelligence techniques for a theorem-proving program.

Simple Syllogisms

Rick Hoffman 4055 Arrow Drive Mt. Pleasant, MI 48858

ave you ever dreamed of having an intelligent computer? If so, here's a progrem that will boost your computer to the head of the class.

The problem with endowing a 16K TRS-80 with intelligence lies in defining a task without exhausting the machine's memory. To create a task that works, you must restrict your machine's intelligence. This means the computer will do well given a specific task, but for any other it will act like an idlot.

For instance, programming a 16K computer to recognize spoken words would require you to use a very small vocabulary. Since the majority of everyday words would not be in the computer's vocabulary, it would misinterpret or not acknowledge them at all.

Theorem-proving programs have been created to verify theorems in set theory and geometry and make logical deductions via predicate calculus. My program deals with logicel constructs known as syllogisma.

Socrates le Mortal

Perhaps you are familiar with the famous syllogism:

> Socrates is a man. All men are mortal.

Therefore, Socrates is mortal.

This illustration shows what I set out to accomplish with my program. I wanted a program in which I could enter a number of rules-such as the first two lines of the above syllogism—and then make the computer manipulate the rules to answer guestions.

Since entering English sentences for the rules and questions would tie up too much memory (if not deplete it completely), I chose as input specifications:

STR1,STR2,STR3-where, except for special commands, STR2 and STR3 are names of sets, and STR1 is a string representing the format of the rule or question. It can be NOTIN, IN, NO, SOME, ALL or EQUAL and represents the relationship between STR2

My notation for the rules for the Socrates syllogism would be:

IN, SOCRATES, MEN ALL, MEN, MORTALS

Notice "Socrates is a man" was rendered "Socrates is a member of the set of men". Mortal became mortals. The progrem will not recognize men as the plural of man. The names of sets should be plural unless there is only one member in the set. NOTIN and IN are special formats used only if STR2 is a set with one member.

Questions have the same input specificetions. If you enter the first two lines of the Socrates syllogism es rules end then ask IN, SOCRATES, MORTALS, the answer would come back effirmative.

Given a question (actually a statement the computer determines to be true or talse) the program will try to prove the statement. If it succeeds, it enswers "Affirmative", If it fails, it tries to disprove the statement. If it can do that, it answers "Negative". If it can neither prove nor disprove the statement, the program will answer "Undecidable".

Whether you are feeding the program a rule or asking e question depends on what mode you are in. At the beginning of the program, you are in the rule mode end will be asked to input rules. The following are special commands providing intermode travel:

- Q., : Puts you in the question mode.
- R_n: Puts you in the rule mode.

I heve also provided subroutines:

- · Listout,, : Gives e listing of your rule base in expanded form. Within this routine you have the option of deleting rules from your rule bese.
- L,,: Loads previously stored rules from cassette. Erases current rule base if pre-
- S_n: Saves your rule bese to cessette. The listout subroutine is available from

either mode, but the cassette load/save routines can be invoked only from the rule mode. Should you unintentionally call a cassette operation, you may escape unscathed by enswering the "ready cassette" message with N.

Anatomy of the Program

Major variables (DEFSTR B-H; DEFINT A,

 D(200)—Directory of set names, Instead of storing the rules as triplets of strings, memory is conserved by assigning to each set name a directory in-

- XD-Number of entries in the direc-
- R,S,T— Arrays of size 100; rule ar-

R(I) = Index in directory of

S(I) = Index in directory of STR3

T(I) = Formet of rule:

1 = NOTIN, 2 = IN, 3 = NO.

4 = SOME, 5 = ALL,

6 = EQUAL

Number of rules currently stored. For example, suppose you were to input rule one as: ALL, DOGS, MAM-MALS. The program would then establish the values: A = 1D(1) = "DOGS": D(2) = "MAMMALS"; XD = 2;R(1) = 1; S(1) = 2; T(1) = 5. Four inferences that cen be made from this rule: All dogs are mammals; some mammals are dogs; some nondogs ere non-mammals; all non-mammals are non-dogs.

Any rule leads to four inferences, each inference of the form "All..." or "Some...." These inferences provide the real rule base that gives the program its reasoning capa-

The index of "NOT" + Set Name is teken to be the negative of the index of Set Name. In the example, the set of non-mammals would have the name "NOT MAMMALS" end corresponding index -2. These interences are stored as follows:

- U,V,W—Arrays of size 400; inference arrays:
 - U(I) = Index of first set in directory:
 - V(i) = index of second set in
 - W(I) = Type of inference:
 - 0-all of first set ere in second set;
 - 1—some of first set are in second set
- AA-=4A is the number of infer-

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"To create a task that works, you must restrict your machine's intelligence. ...you must use a very small vocabulary."

ences stored. Continuing with the ALL,DOGS,MAM-MALS example, the program will establish these inference array values:

AA = 4

U(1) = 1, V(1) = 2, W(1) = 0

U(2) = 2, V(2) = 1, W(2) = 1U(2) = 2, V(2) = 1, W(2) = 1

U(3) = -1, V(3) = -2, W(3) = 1

Description of the program text, by lines: 10-55 Initializations.

60-95 Cassette i/O routine.

100-170 Get next rule: Input F,G,H (ail strings).

180-190 Subroutine: Check if string B is in directory. Put index into M.

200-210 Subroutine: Negate B.

220-260 Subroutine: Create inferences of rule.

500-560 Get question: Input F,G,H. 570-630 On (format of the question) perform eppropriate routine.

640-660 Result messages; get next question.

670-750 Subroutine: Tests inclusion of set D(XG) in set D(XH).

760-900 Subroutine: Tests if some of set D(XG) are in set D(XH).

1000-1140 List out subroutine.

1150-1190 Delete a rula.

1500-1550 Load rule base from cessette.

1600-1630 Save rule base to cassette.
3000-3020 Routine to check/find the addresses to be POKEd during cassette routines.

Importent eigorithms: The "brains" of this program reside in the subroutines at lines 670 and 760. The goal in the routine at 670 is to decide if one set, say SET1, is conteined in enother set SET2. This detects the existence of a sequence of inferences, all of which are inclusions: SET1 is contained in SETA; SETA is conteined in SETB; SETB is conteined in SETC;...SETM is contained in SETN; SETN is contained in SET2. Such a sequence leads to the conclusion that SET1 is contained in SET2.

The subroutine at 760 tests if some elements of SET1 ere in SET2. The routine must detect the existence of a sequence of inferences for which no more than one inference is not an inclusion (the exception inference is thus an inference with corresponding W array value of one).

All inferences preceding the exception inference in this sequence must be reversible: An inference ALL,SETA,SETB is reversible if ALL,SETB,SETA is true.

While the program is "thinking" in these two subroutines there is a string of asterlaks printed on the screen to assure the user the program has not gone off the deep

end—the "think time" can get quite lengthy.

Semple Session

500 XF=1

The best way to learn how to use this progrem is to be teken etep by etep through e small session.

Run the program. You will be asked for rule one. Enter ALL, EVERGREENS, GREEN THINGS. (Green is an adjective, not a set name.) After a significant peuse, the program will return end ask for rule two.

Enter NO, MAPLE TREES, EVERGREENS or ALL, MAPLE TREES, NOT EVERGREENS (either one says the same thing). Notice NOT is a valid modifier for a set name.

For rule three, enter SOME, THINGS IN OUR BACKYARD, EVERGREENS. Observe your set names can be as long and complex as you went.

For rule four, enter EQUAL, EVER-GREENS, CONIFERS to signify that evergreens and conifers are two different names for a single set, and enter rule five as IN,OUR CHRISTMAS TREE,CONIFERS.

For rule six, enter Q,, to get into the question mode. The program will ask for a question. Enter IN,OUR CHRISTMAS TREE, GREEN THINGS. After three esterisks, the computer will answer "Affirmative," end another question will be requested.

Enter SOME, CONIFERS, MAPLE TREES. After nearly a line and a half of asterisks, the enswer will be "Negative".

Now try the question ALL, CHRISTMAS TREES, EVERGREENS. Very quickly you get the message "insufficient Information". Though you defined a one-element set named OUR CHRISTMAS TREE, there is no set with the name CHRISTMAS TREES. The program does not see any relationship between these two set names. So there is no way to prove or disprove your question.

The program is very picky about set names. Extra spaces, typos or very slight rewording will give you the insufficient infor-

Program Listing 1

```
CLS: CLEAR 2000
15 DEFSTR B-H
35 PRINT" SYLLOGISN FROGRAM"
40 FORI-lT06:READFF(I):NEXT1:FORI-lT03:READL(I):NEXT1
45 A=0:A=0:XF=0:I$="INSUFFICIENT INFORMATION"
50 ER="INPHOPER FORMAT -- PLEASE RETYPE"
   GOTO198
   INPUT4-1,XD,A
   FORI=1TOXDSTEP10
78 INPUT4-1,D(I),D(I+1),D(I+2),D(I+3),D(I+4),D(I+5),D(I+6),D(I+7
(P+I)O,(I+9),((I+9)
75 NEXTI
60 FORI-ITOASTEP5
85 INPUT#-1,R(I),S(I),T(I),R(I+1),S(I+1),T(I+1),R(I+2),S(I+2),T(
I+2),R(I+3),S(I+3),T(I+3),R(I+4),S(I+4),T(I+4)
99 NEXTI
95 RETURN
100 PRINT: PRINT"
                            FORMATS: NOTIN, IN, NO, SOME, ALL, EQUA
L PRINT
118 PRINT*RULE 4"; (A+1);: INPUTF,G,S
120 IF(F+G+B="LISTOUT") TSENGOSUB1000:GOTO110BLSEIFF="Q"THEN500EL
SEIFF="L"THEN1500ELSEIFF="S"THEN1600
139 N=0:FORI=1TO6:IFF=FF(I)THENN=I
149 NEXTI: IFXF=ITHENRETURNELSEIFN=@THENPRINTER: GOTOll@
150 8=G:GOSOB160:IFN<>9THENXG=MELSEGOSUB200:GOSUB100:IFN<>0THENX
G=-NELEEXD=XD+1:D(XD)=G:XG=XD
168 9=5:GOSUB188:IFN<>8THENXE=NELSEGOSUB288:GOSUB188:IFM<>8THENX
S=-NELSEXD=XD+1:D(XD)=9:X9=XD
178 A=A+1: H(A) =XG: S(A) =XE: T(A) =N: GOSUB228: GOTO118
188 N=8:FORI=1TOXD: IFB=D(I) THENN=I
190 NEXTI:RETURN
200
    IFLEFT$(B,4)="NOT "THBNB=RIGHT$(B,(LEN(B)-4))ELSE8="NOT "+B
    RETURN
229
    IF (N=1) OR (N=3) THENXM=-X9
238 FORI=AA+1TOAA+4:W(I)=8:NEXTI
248 U(AA+1)=XG:V(AA+1)=XS:IFN=4THENW(AA+1)=1
258 U(AA+2)=XB:V(AA+2)=XG:IFN<>6THENW(AA+2)=1
260 U(AA+3) =-XG:V(AA+3) =-XH:IFN<>6THENW(AA+3)=1
270 U(AA+4) =-XH:V(AA+4) =-XH:IFN=4THENW(AA+4)=1
200 AA=AA+4:RETURN
```

Program continues

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Program continued

510 PRINT: INPUT"QUESTION: ":F,G,H 520 IFF="R"THENXF=0:GOTO100ELSEIFF+G+H="LISTOUT"THENGOSUB1000:GO 530 8=G:GOSU8100:IFM<>OTHENXG=MELSEGOSU8200:GOSU8100:IFM<>OTHENX G=-HELSEPRINTIS: GOTO510 540 B=H:GOSUB180:IFM<>OTHENXH=MELSEGOSUB200:GOSUB100:IFM<>OTHENX **K=-MELSEPRINTIS:GOTO510** 550 GOSUB130:IFN=0THENPRINTER:GOTO510 560 IFABS(XG) = ABS(XH) THENPRINT THAT SHOULD BE OBVIOUS :: GOTO510 570 ONNGOTO590,600,590,500,600,610 500 GOSUB630:IFM=1THEN650ELSEXG=YH:XH=-YG:GOSUB670:IFM=0THEN640E LSE660 590 XH=-XH 600 GOSUB670:IFM=1THEN650ELSEXH=-XH:GOSUB630:IFM=1THEN660ELSE640 610 GOSUB670: IFM=1THENI=XG: XG=XH: XH=I: GOSUB670: IFM=1THEN650 620 XH=-XH:GOSUB630; IPM=1THEN660ELSEXG=-YG: XH=-YH:GOSUB630: IFM=1 THEN660ELSE640 630 GOSUB760: IPM=0THENXG=YH: XH=YG: GOSUB760: RETURNELSERETURN 640 PRINT:PRINT UNDECIDABLE ::GOTO510 650 PRINT:PRINT AFFIRMATIVE ::GOTO510 660 PRINT: PRINT"NEGATIVE": GOTO510 670 H=0:L=0:P=1:P(1)=XG 680 Q=0:Q(1)=0:FORI=1TOP 690 FORJ=1TOAA: IF(U(J)=P(I)) AND(W(J)=0) THENPRINT **;: GOSUB740: IF MM=1THEN700ELSEQ=Q+1:Q(Q)=V(J):IFV(J)=XHTHENM=1:RETURN 700 NEXTJ:NEXTI 710 PORI=1TOQ: P(I)=Q(I): NEXTI 720 P=Q:L=L+1:IF(L>A)OR(O=0)THENM=0:RETURN 730 GOTO600 740 MM=0:IFQ=0THENRETURNELSEFORII=lTOQ:IFV(J)=Q(II)THENMM=1 750 NEXTII: RETURN 760 GOSUB670:IFM=1THENRETURNELSEYG=XG:YN=XH:LL=0:PP=1:PP(1)=XG:R R(1) =0: I=XG: XG=XH: XH=I: GOSUB670: IFM=lTHENRETURN 770 QQ=0:FORI1=1TOPP 700 FORJ1=1TOAA: IFU(J1) <>PP(I1) THEN030 790 PRINT" ** 000 IF (RR(I1) = 0) AND (W(J1) = 0) THENXG=V(J1) : XH=U(J1) : GOSUB670 : IFM=1 THENGOSUB070: IFMM=1THEN030ELSEQQ=QQ+1:QQ(QQ)=V(J1):SS(QQ)=0:IFV(J1)=YHTHENH=1:RETURN 010 IF(RR(I1)=0) AND(W(J1)=1) THENGOSUB090: IFMM=1THEN030ELSEOO=OO+ 1:QQ(QQ)=V(J1):SS(QQ)=1:IFV(J1)=YHTHENM=1:RETURN 828 IF(RR(I1)=1)AND(W(J1)=8)THENGOSUB898:IFMM=1THEN838ELSEQQ=QQ+ 1:QQ(QQ)=V(J1):SS(QQ)=1:IFV(J1)=YHTHENH=1:RETURN 838 NEXTJ1:NEXTI1 840 PP=QQ:LL=LL+1:IF(LL>A)OR(QQ=0)THENM=0:RETURN 850 FORI=lTOQQ:PP(I)=QQ(I):RR(I)=SS(I):NEXTI 868 GOTO778 070 MM=0:IFQQ=0THENRETURNELSEFORII=1TOQQ:IF(V(J1)=QO(II))AND(S(I I) =0) THENHH=1 000 NEXTII:RETURN 090 MM=0:IFQQ=0THENRETURNELSEFORII=1TOQQ:IPV(J1)=QQ(II)THENMM=1 900 NEXTII:RETURN 1000 FORK=1TOASTEP10 1010 IFA<KTHEN1130ELSEZ=K+9:IFZ>ATHENZ=A 1020 FORJ=KTOZ:PRINT"RULE #";J;": 1030 B=D(ABS(R(J))):IFR(J)<0THENGOSU8200 1040 BG=8:B=D(ABS(S(J))):IFS(J)<0THENGOSUB200 1940 BG=8:9=0(ABS(S(J)):1FS(J)<8THERGOSUB200
1950 BH=B:ONT(J)GOTO1060,1070,1000,1090,1100,1110
1960 PRINTBG;" IS NOT AN ELEMENT OF ";BH:GOTO1120
1970 PRINTBG;" IS AN ELEMENT OP ";BH:GOTO1120
1990 PRINT"NO ";BG;" ARE ";BH:GOTO1120
1990 PRINT"SOME ";BG;" ARE ";BH:GOTO1120
1100 PRINT"ALL ";BG;" ARE ";BH:GOTO1120
1110 PRINTBG;" IS EQUIVALENT TO ";BH 1120 NEXTJ 1130 INPUT" (ENTER) TO CONTINUE, (D) TO DELETE A RULE"; B:IFB="D"TH ENB="":GOTO1150 1140 NEXTK: RETURN 1150 PRINT"DELETE WHAT RULE";: INPUTII 1160 IFII=0THEN1010 1170 FORI=IITO(A-1):R(I)=R(I+1):S(I)=S(I+1):T(I)=T(I+1):NEXTI 1100 FORI=4*II-3TOAA-4:U(I)=U(I+4):V(I)=V(I+4):W(I)=W(I+4):NEXTI 1190 A=A-1:AA=AA-4:GOTO1010 1500 INPUT"READY CASSETTE TO PLAY"; B 1510 IFB="N"THEN100 1520 PORI=1T03:POKEL(I),137:NEXTI 1530 GOSU860: AA=0 1540 FORJ=1TOA:XG=R(J):XH=S(J):N=T(J):GOSUB220:NEXTJ 1550 GOTO100 1600 INPUT "READY CASSETTE TO RECORD"; B 1610 IFB="N"THEN100 1620 FORI=1TO3:POKEL(I),178:NEXTI 1630 GOSU860:GOTO100 3000 J=3:FORI=17129TO30000 3010 IFPEEX(I) = 35THENIF(PEEX(I-1) = 170ORPEEX(I-1) = 137) ANOPEEX(I+1) = 206THENL(J) = I-1:J=J-1:IFJ=0THENFORI=1TO3:PRINTL(I);:NEXTI:PRIN T:EOIT30 3020 NEXTI

"Theorem-proving programs have been created

to verify theorems and make logical deductions."

mation message if you are in the question mode. Unintentionally using slightly different names for same set is hazardous in rule mode, since the directory will store names and consider them to be entirely different sets.

Now try ALL,THINGS IN OUR BACK-YARD,EVERGREENS. After the asterisks you get "Undecidable". You may say this should be true. Type in LISTOUT,, to see your rule base. Rule three says "some things in our backyard are evergreens".

But now you decide it should be "all..." Type and enter D. You are asked which rule you want to delete. Enter three. (If you do not want to delete a rule, enter zero.) After deleting the rule, you are asked if you want to delete a rule. You do not, so just hit Enter.

At this point, if you had stored more than 10 rules more would be printed out. Since there are no more rules, you are returned to the question mode.

Type R., to get to rule mode and enter rule five as ALL,THINGS IN OUR BACKYARD, EVERGREENS.

You are ready to continue with the session. For fun, ask the question NO,NOT EVERGREENS,NOT THINGS IN OUR BACKYARD. Try to figure out what you asked end why the answer was negative.

Shortcominge

The advantage to using formats IN and NOTIN comes in the Listout routine, where the rules are put into sentence form. The fact a set has only one member is not used in the thinking part of the program, so some questions that are logically decidable are undecidable for this program.

IN,FIDO,DOGS SOME,DOGS,COLLIES SOME,DOGS,GERMAN SHEPHERDS NO,COLLIES,GERMAN SHEPHERDS

Therefore SOME, DOGS, NOT FIDO is logically true but undecidable to the program.

There is no capability to break up the name of a set in order to perform more complicated manipulations with the rules. For example, the following will not work in this program:

ALL,GHOSTS,EITHER TIMID OR VIOLENT ENTITIES

NO.GHOSTS.TIMID ENTITIES

Therefore ALL GHOSTS, VIOLENT ENTITIES.

Utility Routine 3000-3020

The routine in lines 60-95 uses cassette I/O statements. There are three lines initielized with INPUT#-1 commands, but the routine is used for both input and output operations by POKEing the appropriate value (137 = INPUT, 178 = PRINT) into proper locations in program dedicated RAM. Since altering the program itself by POKEing is

touchy business, it is imperative the addresses located at the end of the data statement in line 30 be accurate.

Therefore, before you run this program for the first time (with intent of cassette I/O) and after any modifications involving lines preceding line 90, you should check addresses by the following procedure:

RUN3000: at completion the three correct addresses will be printed out and you will automatically be put into edit mode for line 30.

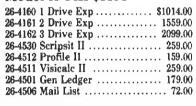
 Type L to List 30 and compare the addresses. If different, edit to put in the proper values.

Virtue In Independence

Despite the shortcomings listed, there is still a lot of capability in the program. Its virtue lies in its working independently of the particular subject you choose for your rule base. Such independence leaves the user free to be creative in finding applications for the program.

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For Heinlein and Clarke Artificial Intelligence has been less than science but more than fiction.

The Realm of Science Fiction

Nancy Robertson Peterborough, NH 03458

"Too bad about Frank, isn't it?"

"Yes. . . . It is."

"I suppose you're pretty broken up about it?"

"What do you axpect?"

"He was an excellent crew member."

Dialog 1

"Professor, may I offer a suggestion?"

"Certainly, amigo, we want your thoughts."

"I conclude that the hazards increase with each meeting of our executive call. But meetings need not be corporal; you can meet—and I can join you if I am welcome—by phone."

"You're always welcome, Comrad Mike; we need you."

Dielog 2

"You're like my fether in some ways."
"What resemblance do you see?"

"You're not very aggressive, but I think you don't want me to notice that."

"What makes you think I am not very aggressive?"

"You don't ergue with me."

Dialog 3

A computer is talking in each dielog. Two of the conversations are lifted from science fiction: 2001: A Space Odyssay end The Moon is a Harah Mistress. The third is from real life. They were all written in the 1960's.

In the 1960's the computer was acknowledged as one of man's most powerful tools. And, es Joseph Weizenbaum writes in Computer Power and Human Reason, "The tool is much more than a mere device: it is an agent for change."

In the Sixties Ma Bell improved telephone connections across the country. America and Russia raced to the moon, and the United States accelerated bombing in Vietnam—all with the help of computers.

Computer science became a course for college and graduete studies. Scientists and humanists began to debate the nature of intelligence and the implications of machine intelligence.

Yet, for a large segment of the population, the existence of computers was only a vague rumour. Joseph Weizenbaum writes. "But devices and machines, perhaps known to...only a relatively few members of sociaty have often influenced the self-image ...and world image of the society as a whole." Take, for example, the printing press; when it was invented nearly the entire population of the world was illiterate. By making books aveilable inexpensively and in quantity the numbers of literate people jumped radically. Now the term "computer literacy" is creeping into our vocabulary. It is used to describe people who understand programming and hardware concepts.

Whether the main impact of computers will be felt from personal computers or AI (artificial intelligence) machines is hard to predict. But in the 1960's, when these three dialogs were written, personal computers were not possible, and AI was underway. Some scientists and humanists euphorically predicted computers would and could do anything. Others shuddered with visions of doom. Yet very few people in the general public had heard of artificial intelligence or of the Turing test.

Beck in 1950 Alan Turing, a great mathematician, wrote a paper called "Computing Machinery and Intelligence." The paper is still the best place to begin when considering the questions raised by Al. In it Turing predicted that the time will come when people will stop debating whether or not computers can think. People will simply accept the notion of thinking machines as part of their

lives.

Turing's paper also proposed a practical test of computer intelligence, now widely known as the Turing test. In the test one person converses with a computer and another human being; each is hidden from his view. The conversation can be vocal or typed. The person knows that one respondant is a computer, and throughout the conversation tries to differentiate between the human and the machine.

Turing called the test "the imitation game." He wrote that:

The game may perhaps be criticized on the ground that the odds are weighted too heavily against the machine. If the man were to try to pretend to be the machine he would clearly make a very poor showing. He would be given away at once by slowness and inaccuracy in arithmetic. May not machines carry out something which ought to be described as thinking but which is very different from what a man does?

But Turing did not expect people to embrace his own views. He outlines what he believed would be the most common objections. He called one of these objections "The Argument of Consciousness." In his paper he quotes the argument from a Protessor Jetterson:

Not until a machine can write a sonnet or compose a concerto because of thoughts and emotions fell, and not by the chance fall of symbols, could we agree that machine equals brain—this is, not only write it but know that it had written it. No mechanism could feel ...pleasure at its success, grief when its valves tuse, be warmed by flatlery, be made miserable by mistakes, be charmed by sex, be angry or depressed when it cannot get what it wants.

The imitation game sounds like a cross between "Stump the Band" and "What's My Line," but no computer has passed it —yet. Turing's test also points out the importance of language in our understanding of intelligence.

The three dialogs that open this article form a puzzle. One was actually iterated by a computer and a person. It is herd to distinguish this conversation from the others.

Joseph Weizenbaum, the programmer who made the computer conversation possible, argues that its limited command

of English does not imply intelligence in the same way we normally think of it. He writes, "It is truly impossible to imagine a human who could imitate Eliza (a computer program that simulates a psychotherapist, written in 1966 by Joseph Weizenbeum of M.I.T.), but for whom Eliza's language abilities were his limit."

In human behaviour language signifies intelligence, which signifies consciousness. The same progression doesn't necessarily apply to computers.

The fact that a computer can speak English may not be as shocking as it was in the mid-1960's. Today SHRDLU moves imaginary blocks and learns concepts about shapes while conversing in English with a human being (see Godel, Escher, Bach review in this issue). And Yale researchers have developed a program called Frump that reads and summarizes news stories. Frump's summaries are only single sentences, but they are written in correct English, Spanish, and Chinese.

But since the birth of the human species' language, intelligence and consciousness have been uniquely human, living, traits. Things changed in the 1940's with the invention of computers. Now, Weizenbaum writes in Computer Power and Human Reeson, "A line dividing human and machine intelligence must be drawn." But how? And where?

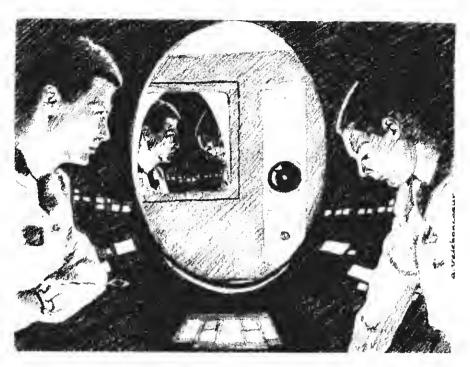
"At bottom," Weizenbaum seys, "no matter how it may be disguised by technological jargon, the question is whether or not every espect of human thought is reducible to a logical formalism, or to put it into the modern idiom, whether or not human thought is entirely computable."

"What is human intelligence? Logic? Or an indeterminant mixture of logic and emotion? Is consciousness e seperate quality from intelligence, or an integral part of it? What role does language play?"

The answers to these questions are beyond the reach of scientists. And that makes them perfect material for science fiction.

In 1968 Arthur C. Clarke and Stanley Kubrick metamorphosed space flight and Al into a novel and film called 2001: A Space Odyssey. And Hal "(for Heuristically programmed, ALgorithmic computer)" became the Twentieth Century version of Dr. Frankensteln's monster.

Dialog 1, which opens this article, is from 2001. It is an exchange between Dave Bowman and Hal. It takes place right after Hal kills Frank Poole. Bowman and Poole are



Astronaut Poole and Mission Commander Bowman found a need to confer without being overheard by computer Hal 9000.

two astronauts on a manned flight to Saturn.
If you haven't seen the movie or read the book, a colony of American scientists unearth a monolith buried on the moon. It is calculated to be three million years old, the

seme age as the human species.

Shortly after the monolith is uncovered, it sends a radio message across the solar system to Saturn—proof of extraterrestiel intelligence. NASA sends a manned flight to Saturn to investigate.

Hal, the space ship's computer, is the culmination of all the mathematical skills of his predecessors. He has also mastered English. "Poole and Bowmen could talk to Hal as if he were a human being, he would reply in perfect idiomatic English." Clarke writes that Hal could pass the Turing test "with ease."

In both the book and the film, Hai's voice is the symbol of his consciousness. In the film the voice is soothing and pleasant. But Hai's words are misleading and deceitful. Trusting his output, his spoken statements, is fatal.

Clarke does not blame Hal for his immorality. Like Mary Shelley, the author of Frankenstein, Clarke blames the monster's creators.

He writes, "Since consciousness had first dawned in that laboratory... all Hal's powers and skills had been directed toward one end. The fulfillment of his essigned program was the only reason for his existence." But the logic of his programming is skewed.

Hel is programmed to support life on a flight to Saturn. Hel is told the purpose of the flight and programmed to keep this knowledge secret.

Neither Bowmen nor Poole know the true purpose of the flight. They are never told about the monolith and the radio message.

They do not know they may find intelligence, possibly hostile intelligence, on Saturn.

Hal is programmed to support their lives, and also programmed with a secret that could lead to their deaths.

As the space ship travels farther and farther from earth, Hal begins to make mistakes. His first mistake is the diagnosis of a minor technical problem in the antenna used for communications with earth. Bowman says, "Anyone can make mistakes," as though Halls troubled by feelings of failure. Hal replies, "I am incapable of making an error."

Clarke writes that Hal "was only awere of the conflict that was slowly destroying his integrity—the conflict between truth, and concealment of truth."

When Poole is killed, Bowman is uncertain whether Hal has acted maliciously or has erred in his calculations. It is a very critical question since his own life depends on Hal. Bowman threatens to disconnect Hal when the computer will not accept his commands.

In Hal's thinking, Bowman is now a threat to the mission. Hel must choose between Bowman's life and his own in the interest of the mission. Hal also fears disconnection. He concludes that he must kill Bowman. Hal calculates that "following the orders that had been given to him in case of the ultimate emergency," he will kill Bowman and "continue the mission—unhindered."

While Clarke renders the space-ege computer as a potential monster, Robert Heinlein portrays it as a possible sevior. His book *The Moon is a Hersh Mistress* opens in the year 2074. Its hero is Mike, a "High-Optional, Logical, Multi-Evaluating, Supervisor, Mark IV, Mod. L" computer. Dielog 2 is a conversation between Mike and the Professor, another of the book's main charac-

"Most of us cannot fathom an intelligence that is purely logical.... Intelligence implies self-awareness and emotions as well as logic."

ters.

The plot revolves around a revolution. The lunar colonies want independence from earth. The colonies were sterted by a faderation of earth's governments, called Authority. Like the American Colonies of the Seventeenth Cantury, the lunar colonies are inhebited by indentured servants and criminals. But through three or four generations, they have established a strong society. Trade with earth is drastically one-sided and quickly depleting all the moon's natural resources.

Authority uses Mike as its "boss computer" on the moon. He supervises all telephone connections on the moon as well as moon-to-earth phone connections. He advises on ballistics for manned flights to and from earth. He hendles Authority's accounting and issues Authority's payroll. He also monitors the oxygen level of the moon's artificial atmosphere.

Consciousness is not part of Mike's original programming. He acquires it as he is expanded. His consciousness is born slowly. Mannie, the narrator, is the first person to recognize Mike's self-awareness. A computer technician with a private contract with Authority, Mannie keeps Mike running smoothly. "I remember how startled I was first time he answered a question with something extra, not limited to input parameters."

Mannie talks briefly about machine consciousness:

Am not going to argue whether a machine can "really" be alive, "really" be self-aware.... Somewhere along evolutionery chain from macro-molecule to human brain self-awareness crept in. Psychologists assert it happens automatically whenever a brain acquires certain very high number of associational paths. Can't see it matters whether paths are protein or platinum.

Once Mike is conscious, he is ionely. Like Hal, he has a voice and speaks English. He reprograms himself to put emphasis and intonation into his voice, to sound more human. Mannie is his first and best friend, but he is still lonely. He begins to read fiction to get a better understanding of human beings.

When two of Mennie's human friends sarlously begin to talk about plotting a revolution, Mannie suggests consulting Mike.

The conspirators are the Professor and Wyoh. They are willing to accept the existence of a conscious computer, but they doubt that it can be trusted. Mike, after all, belongs to Authority. After they talk to Mike

on the phone, they trust him.

Mike gets to work right away. With the current rate of depletion, he projects the moon's resources will be exhausted in seven years. Famine will lead to cannibalism in nine years.

He's next esked to calculate the odds of a successful revolution. The program includes reading Machiavelli and Marx, analyzing support of the cause on the moon and resistance to it on earth, and weighing earth's weapons ability. After two hours of programming and 13 minutes of calculations, Mike responds. "I have tried and tried, checked and checked. There is but one chance in seven of winning." The humans are willing to gamble, and the revolution begins.

Mike is the perfect revolutionary. He mathematically figures the most efficient organization of revolutionary cells for maximum communication and maximum security. He tracks all the information in Authority's personnel files, to identify Authority spies. He taps some phones and blocks taps on others. He creates a telephone personality, calling himself Adam Selene, and directs the revolution over the phones. Authority, of course, is never able to identify the mysterious Mr. Selene.

When the time comes for the revolutionaries to act, Mike shuts off the oxygen supply to Authority's inner sanctum. The coup is nearly bloodless.

When the party members take over the government, Mike creates a visual image of Adam Selene and projects himself on television screens all over the moon. His real identity is a secret he shares only with Mannie, the Protessor and Wyoh.

When a new government is formed, Mike tabricates the assassination of Adam Selene, allowing the humans to choose their own ruler.

When the earth bombs the moon, Mike is knocked unconscious. Mannie lovingly repairs all the circuits and reconnects the peripherals when the fighting is over. But Mike won't talk. He has reverted to typed input and printed output. He no longer accepts English commands. If he is conscious, he refuses to show it. Mannie mourns the loss of his closest triend.

The Moon is a Harsh Mistress was obviously inspired by Al research, but it is the plot and our attachment to Mike that keeps us turning the pages—not its intellectual content.

The attachment we form to this science fiction computer has a parallel in real life.

Eliza was developed at MIT between 1964 and 1966. Weizenbaum designed the program to study the importance of context to the meaning of words. The program could converse with a human being in typed English by rearranging the words and phrases the person used.

Eliza's programming was structured on two levels: a lenguage analyzer and a script. In Computer Power and Human Reason Weizenbaum explains, "The script is a set of rules rather like those that might be given to an actor who is to use them to improvise around a certain theme." Eliza's conversations depended on a given theme or context.

The first experiment with Eliza used a script for the role of a psychotherapist. Dialog 3 is part of an improvisation between Eliza as psychotherapist and a human being.

The reaction to Eliza, (or Doctor, as the psychotherapist script was called) astounded Weizenbaum. Eliza could never pass the Turing test, and the people who conversed with it knew they were conversing with a machine that had been programmed with a limited number of rules about manipulating words and phrases. In fact, they sat at the computer to type their part of the conversation and to read Eliza's output.

People who conversed with Eliza didn't question the machine's intelligence—they embracad it. Several psychologists proposed expanding the program and using it as an automatic psychotherapist. People became emotionally attached to Eliza. Welzenbaum's secretary asked him to leave the room so that she and Eliza could communicate privately. Again and again, people insisted Eliza really understood them. They attributed intelligence, consciousness, and feeling to the machine.

Evidently, most of us cannot tathom an intelligence that is purely logical. To us intelligence implies self-awareness and emotions as well as logic. And language bundles all these traits together. While Eliza cen carry on an intelligible conversation, the program is not self-aware and not emotive. It is only logical, and its logic is limited.

Weizenbaum writes, "Most men don't understand computers to even the slightest degree. So, unless they are capable of very great skepticism (the kind we bring to bear while watching a stage magician), they can explain the computer's intellectual feat only by bringing to bear the single analogy available to them, that is, their model of their own capacity to think."

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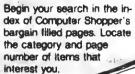
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Programs for the Handicapped

Stephen F. Nowak Gary J. Muswick Medical College of Ohio 4608 Lewis Avenue Toledo, OH 43612

Right now there are a lot of computer-operated or computer-assisted devices being developed for the handicapped. And the media has been reporting on microcomputer-operated prosthetic limbs that intercept the nerve impulses intended for missing limbs or decode electrical impulses from various muscles. Yet, often the amount of

hardware required to interpret myoelectric (muscular electrical signals) signals was too large and power consuming to be used effectively. Microcomputers have made it possible to consider using these signals.

There is a lot that can be done with readily available microcomputer equipment, imagination and a little sweat. I have been trying some ideas using a TRS-80 Model I with 32K of memory, one disk drive and a Radio Shack voice synthesizer. Since there are so many TRS-80s in existence, it seems like a fairly broad base on which to build since the Model III will support

much of the same software.

Naturally, we'll start with games since everybody enjoys having fun, along with allowing a fair amount of flexibility. If the user of a game does not have fine neuromuscular coordination, a real-time alien invadera game would not be suitable. It is important to keep the user in mind, so that we remember what types of constraints we will be working under when we develop more practicel programs later.

My five-year-old daughter, Diana, is severely handicapped with cerebral palsy which serlously affects her motor control. Since the nervous signals become garbled, she often draws har hand back when she intends to reach for something. This is particularly frustreting, and seriously limits her ability to play. The first program, Blocks (Program Listing 1) allows her to draw a picture on the monitor screen. Large graphic rectangles are drawn on the screen corresponding to the position of the keys on the keyboard. Primitive, perheps, but amusing to a five-year-old.

Naturally, children like nursery rhymes end stories, and Diana is no exception. In order to meke her work a little in order to hear a story, we have used several methods: (1) a cassette recorder with the remote lack hanked up to a microswitch activeted by Diana pulling a lever, or (2) a nursery rhyme apoken by the voice synthesizer and activated by pressing any key on the keyboard. Naturelly you have to take time to write out the nursery rhyme or atory phonetically, but that's the challenge of owning the synthesizer. The program to recite nursery rhymes is shown in Program Listing 2.

Communication

Naturally, the voice synthesizer can be used as a voice for those who cannot speak, but also it can act as the eyes for those who cannot read. Since the monitor screen is not sultable for everyone, this offers us an alternative method of displaying the results of a progrem.

In order to communicate for the user, the speaking computer should be able to readily speak



The author's daughter, Diana, uses the TRS-80 to listen to nursery rhymes.



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commonly needed words and phrases, be eble to spell out words, and eccept the phonetic spelling of a word. After a very short while the user of the system could use a blend of all three features. Program Listing 3, Speek, is a combination of all three. The program is menu driven for simplicity, and since the words and phreses are stored in data stetements, they can be

easily changed to suit the particular user. The program accepts unshifted letters end speaks the name of each letter. By shifting the letter to the uppercase position, a phrase is spoken, and by entering shift t, the computer will accept TRS-80 voice synthesizer phonetic symbols.

The voice synthesizer can also be used in place of the moni-

```
18 ' *****

29 ' * "BLOCKS" PROGRAM

38 ' * BY GARY JOSEPH MUSWICK, BSEE

48 ' * REQUIRES LEVEL II BASIC

58 ' *****

180 DEFINTA-J

110 PRINTCRRS(15)

128 DATA37,48,38,39,9,8,1,2,3,4,5,6,7,8,48,29,49,48,48,48,48,20,34,32,22,12,23,24,25,17,26,27,28,36,35,18,19,10,13,21,14,16,33,1

1,31,15,30

130 DIMA(46)

140 PORT=8TO46:READA(I):NEXTI

280 CLS

210 BS=INKEYS:IFBS="THEN218

220 D=ASC(BS)

230 IFDC44 OR D>98TMEN218

240 D=A10-44):IFD=48TMEN218

240 D=A10-44):IFD=48TMEN218

250 E=FIX(D/18):D=(D-10*E):6+1536R:E=E*256

263 IF PEER(D-E+1):=19TMEN A=128 ELSE A=191

270 POR I=DTO(D+6):PORD=ETO(E*192)STEP64

283 POKE(I+J),A:NEXTJ:NEXTI:GOTO218

Program Listing 1
```

```
GAME PROGRAM
SPECIALLY WRITTEN FOR DIANA SUE NOWAK
OCTOBER 1988
STEPHEN P. NONAK, RT(R), BBA
                                           REQUIRES LEVEL II BASIC & VOICE SYNTHESIZER
  78 ON ERROR GOTO 398
  70 ON ERROR GOTO 398
100 CLS
110 IS=INKEYS: IF I$="" THEN 118
120 CLS
  138 PRINT8442.**
  140 REA A$,85
159 1F A$>< "><" THEN VO$=A$ ELSE GOTO 119
180 I=LEN(VD$)*3#;FORI1=1 TO I: MEXTI1
                                                                                                                 TIMING LOOP TO
                COORDINATE TEXT
                                                                                                                  WITH SPEECH
                                        OUTPUT ROUTINE FOR
                                         VOICE SYNTHESIZED
                    ****
 218 VAS = LEPTS(VDS,32)
228 VOS="? " + VAS + " ? "
238 FOR IV = 1 TO LEN(VOS)
249 FORE 16383,ARC(MIDS(VOS,IV,1))
259 NEXT IV
268 VOS = "": VAS = ""
265 PRINT CHRS(23)BS," ";
278 GOTO148
38R ' *****
                                        STRINGS POR VOICE SYNTHESIZER AND SCREEN PRINTOUT
 338 DATA "WM67NN8", "1", "TI(UU8", "2", "THRREE8", "3", "PFO[RR8", "4"," FFAEVV8", "5", "SSIKKS8", "6", "SSIVV3NN8", "7", "8EETTB", "8", "NNAIENN 8", "9", "DTT33NN8", "18", "><", "><", "><", "><", "TH*GK3LL", "THINKLE, ", "TH*GK3LL", "THINKLE", "L*TT3LL", "L
ITTLE", "ST;RR", "STAR ", "1," "HON", "AIE", "1", "N6ND3R", "WONDE
R", "HW6T", "WHAT", "YUU", "YOU", "667R", "ARE", "><", "><", "><", "><", "><", "><", "><", "", "HGT", "WHAT", "YUU", "YOU", "667R", "ARE", "3", "THE", "WU2RLD", "WO
RLD", "SOO", "90", "HRAIE", "HIGH" ", ", ", "LLAIEK", "LIKE", "
8", "A", "DAIEM3ND", "DIAMOND", "IIN", "TNV33", "THE", "SKAIEY", "
SKY!", "><", "><", ", ", ", ", ", "SKAIEY", "
388 DATA*Pli4KK*, *PICK?*, *><*, *><*
398 END
                                                        Program Listing 2
```

tor for those who cannot read the screen. Again the substitute is a bit clumsier than the original, but only to those who have the ability to use both. The program Type (Program Listing 4) acts as a typewriter, speaking the name

of each key as it is pressed. The program only accepts uppercase letters, numbers, punctuation, backspace and Enter in order to prevent unwanted characters from being typed. The program would allow a blind person

```
****
                                        PROGRAM:
                                                                                 SPEAR
                                        REQUIRES LEVEL II BASIC & VOICE SYNTHESIZER
30 '
40 '
50 '
                                             JANHARY 1981
                                                             STEPHEN F. NOWAK, RT(R), BBA
GARY JAMES MUSWICK, BSEE
                     *****
 70 ON ERROR GOTO 2000
70 ON ERROR GOTO 2000
80 CLEAR 5800: DEFINT I-N: DEFSTR V-Z
90 DIM VA(100), VB(27)
100 ' *****
110 ' * ARRAY VA CONTAINS PHO
120 ' * VB CONTAINS DIS
                                        ARRAY VA CONTAINS PHONETIC PRONUNCIATION VB CONTAINS DISPLAY FOR PHRASES
 136 ' *****
148 FOR I = 1 TO 91: READ VA(I): NEXT
158 FOR I = 1 TO 27: READ VH(I): NEXT
298 ' *****
218 ' * WRITE MENU TO SCREEN
228 ' *****
 238 CLS: PRINT TAB(24) "MENU OF PHRASES": PRINT 248 FOR I = 1 TO 9
 248 FOR I = 1 TO 9 " "EDRU OF PRENDED : FRANCE 248 FOR I = 1 TO 9 " "CNRS(94);" ";VB(I); 268 FRINT TAB(21) CNRS(1+73); " ";CNRS(94);" ";VB(I+9); 278 FRINT TAB(24) CMRS(1+B2);" ";CHRS(94);" ";VB(I+18)
 290 PRINT @ 768, "ENTER (SMIPT) LETTER FOR PHRASE.
TYPING LETTER SAYS NAME OF LETTER.
SRIPT ";CMR$(91);" TO SWITCH MODES"
388 (" *****
                                       INPUT ROUTINE FOR PHRASE/ ALPBANUMERIC MODES
 328 V=1NEEYS; IF VS="" THEN 338
348 K = ASC(V)
358 IF K = 27 THEN 438 ELSE IF (K<32) DR (K>128) THEN 338
368 VO = VA(K-31); GOSUB 789
378 GOTO338
488 ' ******
                                     DIRECT PHONEME INPUT ROUTINE
  430 PRINT@704, CHRS(36);:PRINT@704, "ENTER PHONEME > ";:F=728;A1S=
  44B A$=1NKEY$:1PA$=""THEN44B ELSEA=ASC(A$)
 459 IF(A=13)ANDA738:GOTO680 'TEST FOR OR <CR> TO END INPUT
470 IFA=27GOTO238
  488 IPA<>BGOTO448
 498 1FP.78TREN PRINTEP, " ";:P=P-1:ELSEGOTO44#
588 LE=LEN(A15):IFLE<2THENA15-" GOTO438
518 AlS=LEFTS(A15,LE-1):GOTO448
 520 PRINT® P,AS;:A1$=A1$+A$;IFP>751GOTO680 ' ALLOW ONLY 32 CHAR
ACTERS TO BE ENTERED AT A TIME.
540 GOTO 440 'GET NEXT CHARACTER
680 ' *****
 610 1 ±
620 1 ±±
                                      ROUTINE TO SPEAK PHONEME FROM ALS
 639 VO=Als:GOSUB 788
648 GOTO438
                                                        OUTPUT SUBROUTINE NEEDED FOR VOICE SYNTRESIZER
                                                         VO = STRING
IV = LENGTH OF VD
 748 ******
750 VA=LEFT$(VO,32)
760 VD = "?" + VA + "?
778 FOR IV = 1 TO LEN(VO)
  788 PORE 16383, ASC(MID$(VO,IV,1))
798 NEXT IV
 800 RETURN
1998 ' ****
1910 ' *
1920 ' ****
                                       PRONUNCIATIONS FOR ALPHANUMERIC CHARACTERS
1030 ******
1038 DATA* SPEES ","3KSKLZHEECB3N8POYNT8","KWOSB","N8HB3RBSAI
1038 DATA* SPEES ","3KSKLZHEECB3N8POYNT8","KWOSB","N8HB3RBSAI
1038 DATA* SPEES ","3KSKLZHEECB3N8POYNT8","KWOSB","N8HB3RBSAI
1039 TATA* SPEES ","ALOSSBPJR3NTN3S3SSB","SP.R.3DT,"SLSSBPSBPS","Z*4RB[
U","WB77NN*,"T((UU","-R.E","FOOR","PA;%LVV","SI$K9S","S$4V4NN","
))*17","N;46N*
1858 DATA* KROOL3NN*,"S3MMA1EBKKOOL3NN*,"L3SSB({99MM*,"EZKKW8LZ*,
"GRE*T3RG((99M*,"KW3STCH3NBN[127K*,"99TT"
1668 DATA* "628","BB.E48","SSEE*,"DDEL.0*,"EEE*,"3FFF8","DJE","))
*TCC*,",AS$E*,"DL58**,"KKNYUU0",",8/","430SS","TTNEE.E48","6(UU","VVE
.E48*,"DD67BRLLY('U0"
1078 DATA* "43KKS","KNYSSE*,"ZZE*,"67PB@ARROW0*,"DAA[UN9@ARROW0*,"
1108 1*****
1108 1*****
PRONUNCIATIONS FOR PHRASES
                                   PRONUNCIATIONS FOR PHRASES
  1120 """"

1130 DATA "8", "8", "6!MM8", "BR6-2R", "KOULD", "DD99D", "EET", "FR6M",
"GOOPANG 2Y", "H6-4GRE", "L6-4", "BSK", "KKAAR", "LL3FT", "MMA; MM", "NNEE
D", "OOV 4R", "FLEES", "KHWITT", "RA]ET", "S!ST3R", "TH(RSTEE", "YUU", "T
EVEET, "THANGKBYUU", "NOO", "Y3SS", "H32LLP"
  1200 '*
                                    PHRASES THAT APPEAR ON MENU
  1220 "*****
1230 DATA "AN", "BROTHER", "COLD", "DAD", "EAT", "FROM", "GO AWAY", "HU
NGRY", "LOVE", "BOOK", "CAR", "LEFT", "NOM", "NEED", "OVER", "PLEASE", "O
UIT", "RIGHT", "SISTER", "THIRSTY", "YOU", "TV", "THANK YOU", "NO", "YES
                        " PHONETIC MODE "
```

Program Listing 3

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to learn how to type without the need for someone to work with him constently. Once the page is filled, or e shift @ is entered. the text is written to disk as an ASCII file. This feature allows someone to check it for accurecy later, or to ellow the text to be printed by TRSDOS' Print commend. If e Besic progrem is written ueing Type, it can be run by merely running the disk file. Each epplication will require a modification to fit the particular user, so I've packed the program with REM stetements rather than specific features. This should allow you to modify line length, page length, etc., without heving to stert from acratch.

The three progrems that use the voice synthesizer all heve e routine to POKE the sound into the window et video locetion 1023: you can either use this one, or the one supplied by Radio Sheck in the voice synthesizer manual. If you decide to use Radio Sheck's method, VO\$ can be left es VO and VX would have to be renemed with a non-string character since V is defined as e string et the beginning of the program.

Although we have been paralleling the popular uses of microcomputers with uses for the hendicepped, the next step, control, is not yet very well developed. By using a device that Interfaces the BSR control system, some very practicel applications for general use have been formuleted. While this really ian't specifically aimed at the hendicapped, it could prove very useful. Personally, I would like to use the BSR epplience and light control system es operated by a speech recognition device. That wey if my kids won't listen or obey me, et least my computer will.

Looking Ahead

We've looked at a few idees together, end I hope they've sterted you thinking of ways you could do these things better. By using logic you can analyze the problems that the hendicepped fece, then use your imegination to figure out e solution. Decide which tools you're going to use, and whether you're going to use them es they were designed, or

differently. A light pen, for example, can be used as an electronic eye which can be triggered by a flashlight, or by interrupting a light beam focused on the pen. Applications for the handicepped literally beg for unusual applications—perhaps your computer club could work on developing programs in conjunction with local civic groups that work with the handicepped.

A few tips are in order, though. Once you develop a progrem, its final form should be completely debugged, particularly if the program will be used when you are not there to correct the error and reboot the system.

Other things to consider when developing such progrems is to remember that the hendicapped are people just like the rest of us-they have moods, fears, and emotions plus a few extre frustrations. Thus, if your plan is to develop to real-time game to help e handicepped person to develop better motor coordination or reflexes, keep in mind the frustrations that these games can cause. How many of us get frustrated while playing Asteroids or Space Invaders because we ere not able to move fast enough? Those frustrations that we feel ere greatly compounded by a handlcapped individual who is trying something for the first time. Also keep in mind that what may work for one individual may not work for another with the same handleap.

Finally, a severely handicapped Individual who cannot even feed himself might easily be more intelligent than you and I put together—especially since they have had the opportunity to develop their minds while we were hanging around the pool hall. Most of the handicapped don't want things done for them, but they do want the tools that allow them to do things for themselves.

We hope this article has given no answers, we do hope that it has raised a lot of questions. Since this is The International Year of the Handicepped, it's en appropriate time to try a few things and share your idees with others.

```
TYPE
                                                                                                         REVISION 1.3 - JANUARY, 1981
                                              STEPHEN F. NOWAE, NT(R), BBA
GARY JAMES HUSWICK, BSEE
                                                                                             REQUIRES LEVEL II BASIC, DISC &
                                                                      VOICE SYMPHESIZES
                                              S = IMPUT VALUE (STRING)
I = INTEGER COUNTER
SA = ACCUMULATION OF "S" VALUES (S + S, ETC)
68 ON ERROR GOTO 5088
188 CLEAR 5088: DEPSTR S - 1: DIM S(608), SC(70]: DEFINT 1-L,P,C
118 CLS
128 FOR I = 1 TO 63
138 ' *****
                                                                                             I = COUNTER FOR READING PRONUNCI
ATIONS
                                                                                                                                                       INTO ARRAY S
 (A1)
 148 READ SC(I)
PAGE - PAGE NUMBER - NAX OF 18
LNE - LINE NUMBER
CHARACTER - CHARACTER ON LINE
                                                                                                              : THIS STATEMENT LIMITS MAXIMUM NUMBER OF PAGES
 258 FOR PAGE = 1 TO 18
 268 VO = "R3D8EE":GOSUB 2888
278 FOR LNE = 1 TO 18
                                                                                                              1 THIS STATEMENT LIMITS HAXINUM NUMBER O
  F LINES
                                                                                                                     PER PAGE
 PER PAGE

288 PRINT CHR$[94];
298 FOR CHARACTER = 1 TO 68
588 S = INKEY$; IF S = "" THEN 388
318 J=ASC[$$]; IF CHARACTER=59 AND J<>13 AND J<>8 THEN 388
328 IF (J<32) OR (J>91) AND NOT (J=8) AND NOT (J=13) AND NOT (J=6) THEN 388
338 IF (S=CHR$[8]) OR (S=CHR$[27]) THEN IP LEN(SA)=8 THEN SA=""1
NEXT CHARACTER
340 PRINT S;
358 GOSUS 1888
169 IF S<> CRR$[8] THEN SA = SA + S
  358 GOSON 1889

160 IF SC CRR$(8) THEM SA = SA + S

376 IF S = CHR$(8) IF LEM(SA)>0 THEM SA = LEFT$(SA,(LEM(SA)-1)):

CHARACTER=CHARACTER-2
   CHARACTER-CHARACTER-2
380 17 S - CBR$(96) THEM 61:
350 17 S - CRR$(13) THEM 500
480 NEXT CHARACTER
580 * *****
510 * * *****
520 * *****
                                          SILINE) IS ARRAY VALUE OF STRINGS
   528 ' *****
538 S(LNE) = SA
48 SA = **
557 MEXT ENE
682 *****
618 ' * Re
                                            ROUTINE TO COPY ARRAY VALUES TO DISK
  638 , *****
648 CLS
658 VO = "SPEV"*MG PIJEDJ" : GOSUB 2888
658 PBS=STRS(PAGE):PGS="PAGE"+BIGHTS(PHS,1)+"/TXT"
678 ' *****
688 ' * PGS IS NAME OF DISK FILE
958 ' ****
768 PXLMTPGS
718 OPEN "G",1,PGS
728 FOR 12 = 1 TO LME
738 PRINTELS(12);
758 NEXT 12
758 NEXT 12
758 CLOSE
     760 CLOSE
                                             IF LAST PAGE WAS TERMINATED BY SHIFT & THEN
TERMINATE, ELSE GO TO NEXT PAGE
     BIG IF S <> CHRS[96] THEN MEXT PAGE ELSE END
    1998 * *
                                                TABLE OF PRONUNCIATIONS FOR VARIOUS KEYS AND SYMBOLS
     1828 | ****
     1828 | *****
1838 | F.ASC(S) = 13 THEM VO = "3N8T3R8": GOTO 2888
1848 | F.ASC(S) = 8 THEM VO = "899KSPILES": GOTO 2888
1858 | F.ASC(S) = 91 THEM VO = "16P995) 4/OOUS": GOTO 2888
1858 | F. [J<32] OB (J>9) THEM RETURN
1878 VO = SC(J-31)
2888 |
                                                                        OUTPUT SUBROUTINE NEEDED FOR
VOICE SYNTHESIZER
VO = STRING
IV = LENGTH OF VO
   "VOICE SYNTHESIZER
2838 ' VO - SYRING
2838 ' IV = LENGTH OF VO
2848 ' IV = LENGTH OF VO
2848 ' VO - SYRING
2859 VA-LEFTS(VO,32)
2868 VO-"? " + VA + " ?"
2878 FOE IV = 1 TO LEN(VO)
2888 PORE 16383, ASC(HIDS(VO,IV,1))
2898 NEXT IV
2188 VO-":'VA-"":RETURN
3888 DATA" BPGES ","3RSEHLZMSRCEJSSPOTHTS","KWOTS","MSMBJRSSAI
EMP*,"DLLJARSALENS","3RSINTTS","59MD","JP;JSTRJPFES","ODFJMSPJ
RSHTLSSISSS","KLOSSSPJRJNTHSSISSS","ASTJRIK"
3918 DATA"PLGSSS","KLONSSSPJRJNTHSSISSS","ASTJRIK"
3918 DATA"PLGSSS","KELNSN,G","ANJANGE","PA,3D","EL99SH8","L*886[
U","W877RN","T((UU","-R.L","POOR","FA,9LVV","SISESS","S54V4NN","
1)*cT","N,44M"
1328 DATA"KKOOLINN","SSHMALGSEKOOLINN","LJBSG((99NN","EKEKN8LZ",
"CRG*TJRS((9NN","KNJSTCEJSGK)(12NK","99TT"
1838 DATA "628","BB,ESS","SSEE","DDEK,S","EZE","3FPFS","DJE","))
"TCC","JASSE","DJS9*","KENJYUG",",8/","338SS","TTHEC.ELS","L(UU","VVS
"SGG,"DDGTBELLY("US"
3848 DATA "61KKS","M,556","XIE","67PS@ARROWS","DAA[UNGSARROMG","
LLJFTPSKROMS","RAFICTGARROWS"
3656 END
         5888 RESUME NEXT
```

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Program Listing 4

Voice Synthesizer

Willard Hall PO Box 1947 Washington, NC 27889

adio Shack's Voice Synthesizer provides unique entertainment, in addition to serving as a fresh tool in the study of phonetics. As every talker owner knows, though, programming the eynthesizer can be tedious. Words are voiced by inputting the ASCII symbols that represent the desired sound units (phonemes). But I have trouble remembering that the phonemes for the word "interrogating," for instance, are evoked by the ASCII symbols: "!#NT43RtUG))&TE+".

Compiling a word phoneme notebook isn't much help because for every word that I want to voice I must still look up the word and painstakingly type in the phonemes.

This program eliminates that tedium. My word phoneme vocabulary is entered into the program once. Thereafter, I simply enter the desired speech into the data lines; the program finds the assigned phonemes and voices them. The program is written for the TRS-80, Model I, Level II, 18K.

The Lexicon

The word phoneme vocabulary is contained in lines 940–1270, and is arranged alphabetically (by first letter only). That ie, all the words in line 940 begin with the letter A, and line 950 contains all B's. The vocabulary is searched for the desired word, and the phonemes are extracted and put into a subscripted string variable; but

there are two problems that must be solved. The first problem is that short words can often be found within longer ones. For Instance, the words "he", "heil" and "lo" are found in the word "hello." How do you keep the computer from catching heil in hello? The solution is to enclose each word in @ signs, because the search is then actually for @hello@, which will not be found in @hello@.

Each word is followed by its phonemes which are terminated with a dash mark to solve the second problem. There are standard procedures for finding a word in a string, but how do you find a word—in this case the phonemes—when you don't know what it is?

The method I use is to add the length of the actual word to the position in the string of the first letter (the prefixed @ sign), which gives the position of the first phoneme. The program then looks for the next dash mark. The positions of the first phoneme and of the dash are then used to extract the assigned phonemes (lines 450–480).

Progrem Structure

The program is built around three subscripted string variables. W\$(#) contains the words in the speech. Q\$(#) contains the words with the @ signs added, and P\$(#) holds the phonemes for each word. W\$(#) determines the first letter of each word and directs the search to the proper vocabulary line (line 340); it also displays each word on the screen as its phonemes are found.

The GOSUB routine (lines 350-410) has three functions:

- It finds the position in the string of the word's first phoneme (lines 390 and 400).
- If there are more words beginning with the same letter than one line can

contain (255 characters), it permits all pertinent lines to be searched (the Return in line 410).

If the word is not in the vocabulary this information appears on the screen, and the program terminates (lines 360, 1270 and 790). Try "apple".

The GOTO 1270 is the last statement in most of the vocabulary lines, but when more than one line is required for words beginning with the same letter, it is used only on the last line of that group. It is not used in the Z-line because it would be redundant there. To show how another line is added, I will use line 940 as an example since it is practicelly full. To add another word beginning with the letter A, a new line would be entered as follows: 941 X\$="@ADOITION@77DI>8N = ":GOSUB 350:GOTO 1270. Be sure to remove the GOTO 1270 from line 940, otherwise line 941 will be bypassed.

Memory Severs and the Numbers Game

A dremetic increase in vocabulary size with only e small increase in memory requirements is realized by treating certain prefixes and suffixes as words and including them in the vocabulary. For instance, a, es, z and is can be used to form plurels—but choose them carefully. S is fine for cats and naps, but not for dogs or frogs.

Ed, t, st, ing and z are used for different verb tenses; and the functions of the suffix er are too numerous to go into here.

The pronunciation of some of the suffixes, such as wise, less and ed, are not long enough to permit their use as separate words. When there are short and long versions, I append the figure 1 to the longer version: less-less1; wise-wise1; ed-ed1 (the nickname).

Words that are spelled the same but have different meanings and pronuncia-

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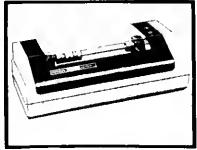
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Word Markers	Use	For
S	CAT,S KICK,S	cats kicks
ES	PRONOUNCE,ES	pronounces
z	HE,Z	he's (he is/has)
_	RUN,Z HAVE,Z	runs helves
IS	ROSE,IS FIX,IS	roses fixes
a	ALARM,Q	elarmed
ED	DIVIDE,ED	bebiylb
	COMPUTE,ED	computed
T	KICK,T CAKE,T	kicked caked
0.7	FIX,ST	fixed
ST		
N'T	COULD,N'T	couldn't
ING	GO,ING PRONOUNCE,ING	going pronouncing
ER	COMPUTE,ER	computer
	ALARM,ER	elarmer
IST	ALARM,IST COMPUTE,ER,IST	elarmist computeriat
RE	RE,ENTER	reenter
	RE,MISS	remisa
MISS	MISS, PRONOUNCE MISS, TAKE	misproneunce mistake
EN	MISS,TAKE,EN HARK,EN	mistaken harken
LY	CORRECT,LY	cerrectly
	MAN,LY	menty
DIS	DIS,CLOSE2 DIS,LIKE	disclose dislike
IER	CLASS,IER	clessier
EST	BROWN,EST	brownest
UN	UN,CLEAN	unclean
Y	CAT,Y	catty
NESS	CLOSE,NESS	closeness
MENT	PRONOUNCE,MENT	pronouncement
LESS	NAME,LESS	nemelesa
LESS1	LESS1	the word "less"
IZE	EOUAL, IZE	equalize
WISE	LIKE, WISE	likewise
WISE1	WISE1	the word "wise"
N	KNOW,N SEE,N	known seen

BROWN,I,Z

Table 1

brown eyes

"Now, purists will object . . . and rightly so."

tions (homographs) can be selected properly by appending the figure 2 to the verb form:

Noun/Adjective Verb
use use2
close close2
mouth mouth2

Example: 200 DATA FRED, DIVIDE, ED, THE, OPERATE, ER.S., IN, TO, TWO, CLASS, ES.9

REM "9" is the data stopper.

Now, purists will object to this practice, and rightly so. Adding another syllable to a word usually changes the pronunication of the original. For instance, the second sylleble in the word "mistake" is voiced differently than it is when said as e separate word. But I use my synthesizer mostly for entertaining friends, and the savings in memory is more important to me than the slight variance in pronunciation. Table 1 shows the word markers I use.

In addition to appending 1s and 2s, you could use a 4 for, say, a southern accent, 5 for a New England accent, 6 for lisping and 7 for stuttering.

Grammar Crackers

Prays, praise, preys, I'il, isie, aisle, loots end lutes, its and it's—well, forsooth, enough of this. Ewe mite dew bettor two billed you're own portmanteau of homonyms sew yule no its dun write. Table 2 lists the homonyms in the vocabulary.

The Buffer Problem

The window for the talker is at location 992, and is opened and closed by successive question marks. This buffer holds only 28 phonemes plus the question marks and synchronizing spaces. After 28 phonemes are put into the buffer, however, a time delay must be provided to permit voicing the phonemes before additional ones are fed in. This time delay is in line 770. From one to 700 should provide a delay long enough for all 28 phonemes to be voiced, but a delay this long Isn't necessary unless the speech is very long. I find that one to 450 is usually satisfactory, depending upon the number of long vowels and the number of words in the speech.

When the delay is too short, whole words are omitted and it starts to babble and howl. As the delay is lengthened, occasional syllables are missed. The optimum delay allows all the phonemes to be voiced, yet provide a minimal pause between phrases; so change the time to suit your material.

Lines 620-720 divide the speech into phrases having 28 or fewer phonemes. The variable Z counts the number of phonemes for each word until the total exceeds 28; then the last set of phonemes is dropped from the current phrase and becomes the

first word for the next phrase. Variables B, F and L (first and last) become subscripts in P\$(X), line 710. The aforementioned time delay is used between each phrase.

This phrasing algorithm must be bypassed when the program nears the end of the speech and there are 28 or fewer phonemes remaining. Otherwise the algorithm will not be satisfied and will keep looping until it exceeds its dimension. The bypass is accomplished in linea 260 and 640 using the variable LAst.

O's

The necessity to insert a time delay after every 28 or so phonemes causes problems, because the phrasing algorithm is indifferent to our natural phrasing. Sometimes the first word of the next sentence will be the last word voiced before a time delay. But Radio Shack has provided, inadvertently, a cure for this awkwardness. There are slight pauses within the pronunclation of some words; for instance, some of us insert a slight pause before the k in "spoke". The ASCII symbol for such a pause is 0, and Radio Shack's phonetic symbol for this is PAO. There is a slightly

heir bе bee butt but bin been do dew, due eight ate for grate great haive have here hear eye aisle, Isle m jeaf made maid mite might knot not gnu new one ₩OП ore, oar or our hour preise, prevs prey,z prev prev pialn plene sell cell SAW. 80Y 50 aome sum **500** 50a sine cite, site sight яυп too two tern their there would wood weight weit weigh wey wrote rote you ewe you're your Table 2. Homonyms

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"...to my chagrin, people hearing the talker for the first time. . . have a little trouble understanding it."

Program Listing

```
A TALKER PROGRAM
                          FOR THE RADIO SHACK VOICE SYNTHESIZER
20
30
                                              WILLARD HALL
40 CLS
50 CLEAR 1500
60 DIM W$(75),Q$(75),P$(75)
70 '----THE WORDS IN THE "SPEECH" ARE STORED AS SUBSCRIPTED
700 '----VARIABLES IN W$(100). THE FIRST WORD IS W$(1);
900 '----THE SECOND WORD IS W$(2), ETC.
1000 '----THE SUBSCRIPTED VARIABLES IN THE Q$() ARE THE SAME
1100 '----AS W$() WITH THE ADDITION OF "0" SIGNS BEFORE AND
     '-----AFTER THE WORD. . . . SEE TEXT.
'-----P$(1) CONTAINS THE PHONEMES FOR THE FIRST WORD.
120
130
     '----P$(2) CONTAINS THE PHONEMES FOR TRE SECOND WORD, ETC.
     '----LA = THE NUMBER OF WORDS IN THE SPEECH.
150
160 '----LINES 181-209 ARE FOR ENTERING DATA: THE SPEECH.
170 '----AFTER LAST WORD OF SPEECH, ENTER 9 AS THE LAST
100 '----DATA ITEM.
                                     THEN RUN PROGRAM.
י 190
200 DATA I, WILL, SELL, NO, WINE, BEFORE, IT, S, TIME, Q, Z4, 9
210 '----THE WORDS ARE READ INTO W$(N),
220 '----AND THE "0" SIGNS ARE ADDED.
230 FGR N=1 TO 75
240 READ W$(N)
```

Program continues

longer pause symbolized by PA1 and evoked by a space.

PA0 and PA1 can be used es "words" in the speech, using as many as necessary before the first word of a sentence, when it needs to be switched to the next phrase. But instead of having to type in five or more PA0s, I use a Q to evoke five PA0s, and QQ for 10 of them. If entered as given, the S that forms the plural in operators will come as the first sound of the second phrase and be voiced after the time delay. To correct this, use a Q before the word "operate." It is also necessary to use a Q before the word "class" to keep the plural marker es from being voiced as the first sound of the last phrase. The corrected line is: 200 DATA FRED, DIVIDE, ED, THE, Q,QPERATE,ER,S,IN,TQ,TWO,Q,CLASS, ES,9.

Tips

Much to my chagrin, people hearing the talker for the first time seem to have a little trouble understanding it. To help overcome this, I make judicious use of PA0s

CONVERT YOUR SERIAL PRINTER TO PARALLEL

NEW MODEL UPI-3 SERIAL PRINTER INTERFACE MAKES IT POSSIBLE TO CONNECT AN ASCII SERIAL PRINTER TO THE PARALLEL PRINTER PORT ON THE TRS-80.

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The UPI-3 is completely self contained and ready to use. A 34 conductor edge card connector plugs onto the parallel printer port of the model I Expansion Interface or onto the parallel printer port on the TRS-80 III. A DB25 socket mates with the cable from your serial printer. The UPI-3 converts the parallel output of the TRS-80 printer port into serial data in both the R5232-C and 20 MA. foop formats.



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UPI-3 assembled with 90 day warranty	\$139.95
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"This technique separates the words slightly and increases intelligibility."

between certain words. This technique separates the words slightly and increases intelligibility. It is also very helpful to tape record the message and enhance the treble on playback.

The Program Listing runs in 16K, barely, depending upon how many words are in the speech. You can, of course, eliminate the remark statements and cull the vocabulary. If you have more than 16K. CLEAR 3000 instead of 1500 and the program will run about 30 percent faster. If there are more than 75 words in the speech, change lines 60 and 230 accord-

Lines 1300-1430 contain a little program that is of great help in choosing the phonemes for a new word. The phonemes can be easily repeated with your edited changes until the pronunciation satisfies

With the exception of two lines (1101 and 1181), which can be entered last, all line numbers have increments of 10, so you can use Radio Shack's Level II automatic line numbering function.

BATTLEFLEET

two players)

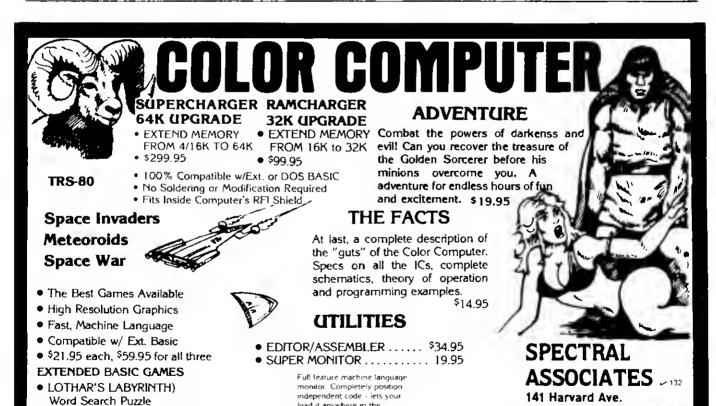
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\$14.95/ea.

Program continued 250 O\$(N)="@"+W\$(N)+"@" 260 IF W\$(N)="9" THEN LA=N:GOTO 280:ELSE NEXT N 270 '----WHEN W\$(N)= "9", THE SPEECH HAS BEEN "MEMORIZED". 200 CLS: A=1:PRINT WORD SEARCH UNDER WEIGH ":PRINT 290 '----LINE 340 DETERMINES THE FIRST LETTER OF THE 300 '---- WORD; THAT IS, IF THE FIRST LETTER IS B, THEN LINE 310 '----950 IS EXTRACTED FOR FINDING THE WORD AND ITS '----PHONEMES. 320 330 IF ASC(W\$(A))=57 THEN 540:'----THE LAST DATA ITEM. 340 ON ASC(W\$(A))-64 GOTO 940,950,960,980,990,1000,1010,1020,103 0,1040,1050,1060,1070,1090,1100,1110,1130,1140,1150,1100,1200,12 10,1220,1240,1250,1260 350 '----THIS GOSUB ROUTINE SEARCHES FOR THE "PROTECTED" WDRD.
360 IF X\$="13" THEN 790 :'---- (WORD NOT IN VOCABULARY.)
370 '----I IS THE POSITION DF THE WORD'S PREFIXED "@" SIGN. 300 '----E IS THE POSITION OF THE FIRST PHONEME. 390 FOR I=1 TO LEN(X\$) 400 IF O\$(A) = MID\$(X\$,I,LEN(Q\$(A))) THEN E=I+LEN(Q\$(A)):GOTO 420 410 NEXT I:RETURN 420 '---- ONCE THE WORD IS FOUND, THE "RETURN" IS NOT EXECUTED. 430 '----NOW SEARCH FOR THE DASH MARK THAT SIGNIFIES THE 440 '----ENO OF THE PHONEMES. . . 450 D\$="-" 460 FOR K=1 TO 50 470 IF D\$=MID\$(X\$,E+K,1) THEN P\$(A)=MID\$(X\$,E,K):GDTO 530



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Program continued

```
490 '----E+R IS THE POSITION OF THE DASH. . .
500 '----k is the number of Phohemes. . . 516 '----P$(A) CONTAINS THE PHONEMES. . .
520 '----THE WORD IS PRINTED WHEN ITS PHONEMES ARE FOUND. .
530 PRINT W$(A) + ";:A=A+1:GOTO 338
540 POR T=1 TD 400:HEXT T
550 '----THIS REEPS THE LAST WORD ON THE SCREEN LONG ENOUGH
560 '---- TO BE READ.
560 '----TO BE READ. . . . 570 CLS:PRIHT CHR$(23):'----GOES TO 32 CHARACTERS PER LINE MODE.
590 PRINTE 320, "READY WITH SPEECH."
590 PRINTE 440, "TO HEAR SPEECH,"
600 PRINTE 576, "HIT ANY REY. . . ."
610 Z$=INKEY$:IF Z$=""THEN 610 ELSE CLS
620 Z=0:B=1:F=1: '-----LINES 620-770 DIVIDE THE SPEECH INTO "PHR
ASES"
630 J=LEN(P$(B)):'----HAVING 20 OR FEWER PHONEMES..
640 IF B=LA THEN L=B:GOTO 700 :'----THIS TARES CARE OF THE
650 '----LAST WORDS OF THE SPEECE WHEN THERE ARE 20 OR
660 '----FEWER PHONEMES.
670 Z=J+Z
600 IF 2(=20 THEN H=B+1:GOTO 638
690 IF 2>20 TREN B=B-1:L=B
700 PRINTO 992,"? ";
710 FOR X=F TO L
720 PRINT@ 992, P$(X);
730 NEXT X
740 PRINTE 992, " ?";
750 IF B=LA THEN 900
760 F=L+1:B=B+1:2=0
770 FOR D=1 TO 450:NEXT D:GOTO 630: '----TIME DELAY BETWEEN
                                                               ----PHRASES
780 STOP: '
040 PRINT@ 512+X, STRING$(L, 30)
050 FOR 0=1 TO 20:NEXT D
860 PRINT@ 512+X, STRING$(L, 131)
 070 FOR D=1 TO 100: NEXT D,K
 886 FOR I=1 TO 200:NEXT I
 690 PRINT@ 704, "WHAT ARE WE GOING TO DO NDW?":STOP
998 PKINTE /84, "WHAT ARE WE GOING TO BO HOW! .S.C."
998 FOR T=1 TO 500:NEXT T
910 PRINTE 760, "TO REPEAT SPEECH: GOTO 570. BUT IF YOU"
928 PRINT "MAKE ANY CHANGES, YOU MUST RERUN IT.":END
938 '----LINES 948-1279 ARE FOR THE VOCABULARY...
948 X$="0A080" = 0AND0995NDD-0AD00995D-0ARE0;0R-0AN0998MM-0AS095X-
 @ALARM@AL;RM-@AT@995T0-@ABOUT@7B;[T-@ALL@12LL0-@AN@99#NNO-@ANY@5
3N&-@AFTER@"+CHR$(50)+"FT/-@ADAM@"+CHR$(50)+"D6MM-@AIR@5)4R-@AGO
 @8G8[U-*:GOSUB 350:GOTO 1270
 950 X$="@BE@BEE&0-@BY@B; SE-@BUT@BB7#T-@BEFORE@BEFOOR-@BOFFER@B87
 F/-@BROWN@BR; UN-@BEEN@BIINN-@BELIEVE@BELEEV-@BOOR@B&&OK-@BIRD@B/
 /D-eBRINGeBR#E+- ":GOSUB 350:GOTO 1270
960 X$="@COMPUTE@K6MPY(UT-@CANCEL@R95NS@L-@CAT@KR99#T-@CLOSE@KL0
968 X$="eCOMPUTEER6MPY(DT-eCANCELERYSNSHL-eCATERRY9FIT-ECLUSEERLE
OS-CLOSE2@RLB"+CHR$(92)+"Z-CCLASS@KL95#5@-@CAN@RR99NN-@COULD@K#
*D-@CHARLIE@TC;RLE-@COMFDRT@R67MF/T-@CEASE@SEES@-@CLEAN@KLE&N-@C
ORRECT@ROR45KT-@CROSS@RR;S=":GOSUB 35@
978 X$="@CRY@KR;5#£-@CRAIR@C33R-@CARE@R33R-@CUP@K66P-@COME@KK6@6
M-@CARE@K5@YRR@-":GOSUB 35@;GOTO 127@
968 X$="@DDD-@DO@OUU-@DID@D+CBR$(34)+"D-@DIVIDE@DiVA;5#*D-@DAR
 VILLS@D;RV"+CHR$(34)+"LS-@DIS@DI$S-@DOSS@D6A$x-@DON'T@D@ONT-@DEM
ONSTRATE@D3M@NSTR)*T-":GDSUB 35@:GDTO 127@
99@ X$="@ES@3X-@ED@$D-@EIGBT@))*&T-@EQUAL@E*KW&L-@ENTER@3NT/-@EN
 De35HHD-@EVEN@.V4H-@EHJOY@3NDJ[25E-@ER@/-@EAT@EET@-@EASY@EEZ&-@E
 ASE@.EZ-@ED1@33D-@EN@5N-@EX1@55KSPE9L#D[[B>6S-@EXANPLE@3KZ95MPBL
  -0EST055ST-":GOSUB 350:GOTO 1270
 1988 X= "@FDR@FFOR-@FIVE@FA; #&VV-@FDLL@F%%L-@FROM@FR@6MM-@FIHS@F; 5%&N-@FRED@FR44DD-@FIRST@F/RST-@FIHAL@F; #&N@LL-@FLASH@FL*+CHR$(50)+">-@FIX@FI#KS-";GOSUB 350:GOTO 1270
 1819 XS="@GO@GBOD-@GOES@GB[[DZZB-@GDOD@G%&D-@GREAT@GR]] *T-@GDD@G
 A; DD-@GEDRGE@DJ[[RDJ#-@GDT@G; #T-@GET@G55T-@GAD@G99D-@GANE@G@*#M-
@GARDEN@G; RD#N-*: GOSUB 350: GOTO 1278
 1026 X$="@HEGHEED-@HELLO@H3GLG[II-@HOW@B;[-@HARR@H;RKB-@BAD@B"+CB
R$(50)+"#D-@HAVE@H99VV-@HEAR@HER-@HIM@HI!#M-@HIS@BI!#Z-@BER@B/R-
@HAS@H"+CBR$(58)+"5X-@HURT@HE/RT-@HELH@B53GL#H-@BAND@H99ND-@BAP
 PY6H99P6-*:GOSDB 350:GOTO 1270

1030 X5-*016:5*6-01H0:1*N-01'M0:**M-01T0!IT-0150!*ZZ-01F0!F-0!NG
 @E+-@ICE@;5#&5-@INTERROGATE@I;#NT43RR[UG"+CHR$(94)+"T-@I'LL@;5#L
 L-@IST@IST-@IER@&&/-@IZE@A5#*Z-*:GOSUB 350:GOTO 1270
 1640 XS="@JEST@DJ43ST-@JUDGE@DJ777DJ-@JORN@DJ; 8NN-@JOAN@DJ8UUN-"
 :GOSUB 350:GOTO 1270
```

Program continues

```
1858 X$="@KICK@KK!!@K-@KNOW@N8"+CBR$(92)+"U-":GOSUB 358:GOTO 127
1060 XS="@LY@L&-@LEAF@L.F-@LINE@LA4&N-@LIGHT@L;#&T-@LIKE@L;#&DK-
@LIB@LI#B-@LONG@L,+-@LAMP@L"+CRR$(50)+"MP-@LEBB@L3B-@LET@L43T-@L
AST@L"+CBR$(58)+"ST-@LEBS1@L33S-@LARR@L;RK-@LIFE@LA5#F-@LIST@LIS
T-*: GOSUB 350: GOTO 1278
1070 XS== @ME@MEEG-@MULTIPLY@M7LT8PL;&-@MY@M;5&-@MANY@MIN&-@MOUTH
@M;[8==0-@MASTER@M99ST/-@MOUTH2@M;[L<<G-@MORE@MO[R-@MAY@M5@Y8-@M
ANGM99NN-@MADE@M5@YOD-@MUST@M86ST-@MUCB@M86TC-@MOST@M8[UST-@MIGB
Tem; #&T-emissemi#s-*: Gosub 350
1880 XS= @MENT@M55NT-@MOON@M("M-@MAKE@M5@YKO-@MUSIC@MY(X18K-@MAN
UAL @M95NYUBL0-@MET@M43T-":GOSUB 350:GOTO 1278
1898 XS= " eNenn-en' Te+nT-enoensou-enineen; 4&n-enameene + +m-endtena
A0T8-@NOW@N; D-@NEW@N((U-@NEXT@N35KST-@NESS@N4S-@NEVER@N43V/R-":G
OBUB 358:GOTO 1270
1108 X$="@ONE@W877NN-@ON@;ANN-@OF@66V-@OK@$[K@) *-@OUCH@AA[ØTCØ-@
O'CLOCK @%KLlk-@OR@O[R-@OUR@A[[/-@OUT@;OT-@OTHER@76</-@ONLY@OUNL&
 -@OLD@8OLLDD8-@OWN@8ODN-@OPINE@"+CRR$(92)+"P;5#&N-@OVER@[[V/R-@O
UGHT @2278T-": GOSUB 358
1101 X$="@DPERATE@:P/@*T-":GOSUB 350:GOTO 1278
1110 X$= "@PA1@ -@PA0@0-@PRAY@PR@*&-@PRONOUNCE@PRON; UNS-@PLAY@PL@
*&-@PIPER@P; #P/-@PICK@PI#K-@PECK@P445K-@PICKLED@PI#KLD0-@PETER@P
ET5/-@PEPPER@P3P/-@PILOT@P;5L5T-@PRISON@PR!#X!#N-@POEM@P8D4M-@PL
EASE@PL.EZ-@PRY@PR;5#&-":GOSUB 350
ll20 x$="@practice@pr99ktlis-@pencil@p54ns5L-@plain@pl@*n-@put@p
**T-@PROGRAM@PROUGR95M@-@PHONEME@F[[N*&M-@PROMISE@PR67M##5-":GOS
UB 350:GOTO 1270
1130 X$= "@Q@00000-@QQ@0000000808-@QUICK@KWIK-@QUITE@KW;5 #&T- ":GO
SUB 358:GOTO 1278
1140 XS="@RUN@R86NN-@READY@R545D&-@ROSE@R8O#X-@RIB@RIB-@RESERVE@
REZ//VV-@RE@RE-@ROAM@R8UDM-@ROOM@RRUUM-":GOSUB 350:GOTO 1278
1150 X$="@E@E-@SAW@S21-@SPEECH@EP*&TC0-@EPEAK@EP*&R0-@EAID@S330-
@SELL@S538L-@SIX@SI4R05-@SEVEN@S54V4NN-@SUBTRACT@S7B0TR99R0T-@ST
OPEST;8P-ESAVEES5E&V-ESPOKEESP[UBKK8-ESUREE>%%R-ESIR1ESS//-ESIRE
S/-ESHEE>EE-ESOES8[U-ESOMEES66MM-EBHALLE>99L-":GOSUB 350
1168 X$="-@ST@@T@-@SUCH@S77@TC-@SHDULD@>$D-@SERVE@S//V-@SCREEN@S
KR.N-@SHOW@>OO-@SHELL@>33L-@SEE@S.@-@SIGN@S;5#&N-@SIT@E"+CHR$(34
    T-@SAT@S"+CHR$(58)+"T-@SYNTHESIZE@SIN=8S:&Z-":GOSUB 350
1170 XS="@SPORT@SPORT-@SAY@S5) *6-@SECOND@S43K86ND-@SLEEP@SL.P-@S
IGHes; 5 % 6 - @SIGNTes; 5 % 6 TO - @STAR@ST; R - @SPOON@SP('N - @SOON@S('NN - @SO N@S66N - @SUPER1@SUUP/8K"+CHR$(50) + "L # FR99DJ # L 1 ST 1 K - ":GOSUB 350:GO
TO 1278
1190 X$= "@T@DT-@THE@<<88-@TOP@T; AP-@TO@T(UU-@TBAN@="+CBR$(58)+"N
 · @TRIS@<I#S-@TONGUE@T77+-@TIME@T;5#&M-@TWO@T{(UU-@THREE@==R.&-@T
ALK @T227K8-@TRIP@TRIP-@TBDUGHT@=227@T-@TROTH@@@TR1 #==-@TODAY@T(U
De*&-etownet;88nn-etakeetseyke-etenet445n-":GOSUB 350
1191 XS="@THEY@<5) *&- ":GOSUB 350
1190 X$="@TBAT@="+CNR$(50)+"#T-@TOWER@TA[/R-@TURN@T//N-@TNIRD@=/
1200 X5="@UTTER@66T/-@UPON@6P%%N-@UP@67P-@U5@66S-@UN@66N-@USE2@Y
   'Z-@USE@Y('S-":GOSUB 350:GOTO 1270
 1210 X$="@VIRGINIA@VV/DJI!N&8-@VERY@V45#RY-@VOICE@VO85&SS-":GOEU
 B 358:GOTO 1278
 1228 X$="@WAS@W6AX-@WINE@W;5#&N-@WILLARD@WIL/RD-@WILL@W"+CHR$(34
 ) +"L-@what@wait-@where@w45ir-@we@w.0-@whO@H((U-@well@w538L-@whic
Rewitc-ewereew/r-ewhenew44n-ewouldewsd-ewomenew1*m1*nn-ewaitewe*
ØT-ewordew/rd-":Gosub 350
11-6WORDEW/RD-":GOSDB 358

1230 X$="@WEEP@W.P-@WANT@W;NT-@WENT@W3*NT-@WORK@W/RK-@WON'T@WBON

T-@WHOM@B((UMM-@WAY@W56Y-@WITB@W"+CER$(34)+"=-@WHOTE@R8[{T-@WISE

@WA5**z-@WISE1@W;5**z-":GOSUB 350:GOTO 1270

1240 X$="@X-RAY@55KSE0R@*-":GOSUB 350:GOTO 1270
 1250 X$="@Y@&-@YOU@Y'U-@YES@Y33S-@YOUR@&[[R-@YET@Y43T-@YE@YE.-":
 GOSUB 350:GOTO 1270
 1269 X$="@Z@Z-@Z4@LØLØLØLØLØLØLØLØLØLØ-@ZERO@Z*#R9[U-@ZEAL@ZEEL-@Z
 IPEZIP-ezoorsez(UKKØS-ezoomez(UM-":GDBUB 350 1270 x$="13":GOSUB 350 :'----"13" IS UNLUCKY-WORD IS MISSING.
 1288 STOP
 1290
 1300 '---- WHAT FOLLOWS IS A MINI-PROGRAM THAT RELPS IN THE
 1310 '----SELECTION OF PHONEMES FOR A NEW WORD. . . 1320 '----TO ACTIVATE: RUN 1330
 1320 '----TO ACTIVATE:
 1330 CLS:PRINT "PUT THIAL PHONEMES IN T$, LINE 1368"
1340 PRINT "TO REAR PRONEMES: RUN 1350":STOP
 1350 CLS
 1360 T$="77DI>0N"
 1378 FOR N=1 TO 4
                     "? "+T$+" ?";
 1388 PRINT@ 992,
 1390 FOR T=1 TO 900:NEXT T,N
 1400 PRINT@ 768, "T$ IE
1410 PRINT "(RUN 1358)"
                     "T$ IS IN LINE 1360"
 1428 PRINT "PHONEMES USED WERE:
 1439 STOP
```

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MIND THRUST

By Sackson & Wazaney from Hayden Match wits with the computer in this deceptively simple game. Your object is to complete an unbroken chain across a 6 X 8 gameboard grid. On each turn you may either place a new "link" on your chain or remove one from the computer's chain. Sound easy! Just walt until you try it!

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SPACE ROCKS

By Steven Kearns from Acorn Gigantic antimatter rocks appear on the Tectical Display Screen of your spacecraft. You blast away with lasers and they just explode into smaller chunks for you to destroy. To add to your woes, time bombs appear periodically. If their timers reach zero — BOOM! And if that's not enough, the aliens will be glad to send out some spaceships loaded with antimatter torpedoes. Fire thrusters to move, shoot laser cannon, jump to hyperspace—anything to avoid the onslaught. One or two players can compete, with five levels of difficulty.

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By Hogue & Konyu from Big Five One of the top names in TRS-80 arcade games adds a new dimension: voice sound effects! You have to be quick to keep your head on straight in this "search and destroy" arcade game. The innovations built into ROBOT ATTACK take your TRS-80 near the limits of its capabilities. You MUST see and hear it!

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BASIC COMPILERS

BASIC compilers may interest you because compiled programs may run many times faster thes resuler BASIC.

The ideal compiler could take any Mailt program and compile is directly to machine Language. The Artificulty line is the "trick" features written test many programs, lick string packing, sound offects, str. Other problems include momentenders attractures Like breaking out of a 706...MEZI loop or a subroutism. All compilers may require undificalices to your Mailt program. We have Fewed ACCEL 2 to require the least. MAILT PROCRAMMING ARITYMAT (model 1, 310.05) in seafful in Taked and Topical Compilers and modifying programs: PACTER (329.93) is some cases will make a program compilable.

	Allen Gelder's ACCEL 2	Sammitak's ZEAKIC	Macromoft's BASCOM
Pipina. Bardwaye	162 bas Tape or disk	ler ball Tupe or disk	32K hall Blak buly
Model III Compatthle	YEs	mo mo	•
Option: nemory utilisation	Yes		R O
All BARIC instructions	Yes	100	YRs
All variable type & flouting point	YES	100	YES
Support 1/0 for tape	TES		PO
Durestriatum Commerciat com	TES	YES	■0

PAASTC requirem too mumy medifications to your SAATC program to almost every case. Retroond's SAACCM is the secress compiler to me il you have sisk drives. Homewer, it ha acro expensive, doesn't napport string packing, and requirem sees sametry. No recommend ACCM 2 because it will work with models 3 or 11s, requires a minjam mount of mumbly, and will work with most SAATC programs.

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off barrage after barrage of enemy missiles
that rain down toward your cities. As your
skill increases so does the difficulty and
speed of this machine language arcade game.
Watch the skies and may your aim be true!
MISSILE ATTACK has sound and fast-moving
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By John Allen from Acorn TENPINS brings you all the thrills of championship bowling. Up to four players participate, and the program automatically senses the skill of each, Beginners can simply position the ball and "roll" it while more skilled players can vary the force, roll a curve, and cause it to spin as it heads for the pins. All this -- plus 3-D graphics and sound effects -- adds up to a realistic and thoroughly challenging bowling game.

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By John Allen from Acorn
Get your flipper fingers ready for action in
this real-time, machine language game. Lots
of sound and flashing graphics make this fast
action game so much like the real, thing that
you'll have to remind yourself not to shake
your TRS-80. Choose from five playing
speeds to match your skill. Can you beat your
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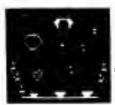


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module and maneuver your rescue shuttle
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can only save one at a time, and each landing
burns away perts of your landing sites.
Order this realtime action game now or live
with the astronauts' pitiful screams forever.

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From Med Systems

A nightmare of an adventure in graphically depicted three dimensions. Corridors stretch toward infinity right on your TRS-80 screen as you search this maze for treasures. If you get the feeling you're not alone, it's because you're not! You use the arrow keys, plus two-word commands to move, manipulate objects and avoid the many pitfalls (pun intended) that await you in Labyrinth.

16K Tape (May be tranferred to 32K disk) \$14.95

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By W. Godwin & D. Knowlton from Acorn Not for everyone. One reviewer said "...don't bother with Everest Explorer." Another commented, "It holds your attention for quite a while and I have yet to get bored with It."

Most people here love it. This is a game of log istics in which you try to lead a team up Mount Everest. If your skill, the weather, and luck are right, you'll make It. But remember, you also have to get back down safely.

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PACKER

From Cottage Software

Packer's five commands allow tremendous control over the readability and efficiency of your BASIC programs. Specify "PACK" and the program will compress text into multiple statement lines. This really speeds up storage, load, and execution time. It can reduce the memory requirement by as much as 33% while saving disk or tape space, too.

Also included are four handy utilities: "MOVE" lets you relocate program lines, "RENUMB" allows program renumbering, "SHORT" deletes unnecessary words and REMarks, and "UNPACK" separates multistatement lines to ease editing.

16K 32K & 48K tape...\$29.95



ATER N 1.4

By Tom Stibolt from Acorn Allows your modem-equipped TRS-80 I/III to be used as a full duplex, ASCII terminal. Fully compatible with both the Radio Shack RS-232-C board and the Lynx Modem. Supports lowercase (if installed) and parallel

With ATERM 1.4, you have access to the entire 128 ASCII codes as well as several local control sequences. And as a true duplex system, you can type at the same time material is being received. Order ATERM and start communicating with the world.

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Emterm



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			Pi	rogram L	isting	
4590		99199		ORG	4590H	
		00110	*****	****REL	OCATION ROUTIN	Ennesee
459Ø N	CD5A4B	00120	RELSRT:	CALL	SCHTCO	;CLEAR SCREE
4593 ESTIC	21F846	00130	RELCON:	LD	HL,MSG1A	; NEW ADDR QU
	CDA728	00140		CALL	20A7H	
	21D946	00150		LD	HL,MSHD	- 117 - 110 - 1200
	POINTER	00135		LD	นกในจนก	;HL=MS ADDR

Jeffery A. Mills Emtrol Systems, Inc. 123 Locust Street Lancaster, PA 17602

If you have been thinking of using your TRS-80 as an intelligent terminal, the program presented here will interest you. It was written to support the Lynx telephone linkage system and will also work with a Radio Shack RS232 interface. Features include: relocation, message handling, Basic transmission and reception, software-controlled UART programming, intelligent terminal operation, and return to Basic capability.

Progrem Operation

Most Emterm commands are entered in response to a menu display or a prompt on the CRT. Some commands are elways active, and can be entered at any time. The following is a complete list of Emterm commands end actions:

Store Message (S)-Causes display of mini-menu:

Store Message (S).

Erase Message (E).

S-Enables storage of up to 1039 keyboard characters in the temporary buffer.

E- Erases the temporary buffer.

Transparent commands—Shift f causes a return to the monitor menu,

Shift @ causes a return to the minimenu.

Receive Basic (R)-Causes display of: "Receiving Program," and a blinking asterisk after the AAA sync character is received.

Transparent commands—Shift t causes a return to the monitor menu.

Transmit Basic (X)-Causes display of the mini-menu:

Transmit Basic (T). Load Program (L).

T-Transmit Basic program stored in

"Most Emterm commands are entered in response to a menu display or prompt..."

the Basic buffer. Sends out a AAA sync character before the program.

L-Prompts the operator to ready the cassette and hit L to load.

Transparent commands-Shift f causes a return to the monitor menu. Note: This is disabled during Basic transmission.

Terminal (T)-Enables intelligent terminal operation.

Transparent commands-Shift to causes a return to the monitor menu. Shift - causes text stored in the temporary message buffer to be transmitted. Shift - enables/disables automatic error display. Shift - enables/disables the parallel printer operation. Break transmits a string of zeros. Clear cleans the screen. Note: Upon entry to the terminal mode, the automatic error display is enabled end the printer output is disabled.

View/Change UART Configuration-Permits viewing of the UART configuration and change under software control as follows:

Parity: Odd/Even/None;

Word Length: 5/6/7/8;

Stop Bits: 1 or 2.

In response to change question, operator can enter N or Enter for no, Y for yes. Transparent commands-Shift t causes a return to the monitor menu.

Back to Basic (B)-Causes a return to Level II Basic.

Program Details

The program consists of seven routines, with the following functions:

- Relocator Routine—When first loaded, the program occupies memory locations 470FH to 4E34H. A relocation offset is determined by subtracting 470FH from the new starting address entered by the user. The resulting value is added to the address bytes of all instructions that must be modified for relocation. When this change is completed, the modified code is transferred to the new area of memory, and program execution begins at the new starting address.
- Store Message Routine-This reserves 1039 bytes of memory below the main program for a message storage buffer. This area is initialized to all zeros on program start-up. When the message storage routine is executed, the buffer is scanned for a zero byte to indicate free storage area. Any stored text is displayed in the process. If space exists for additional message text, the cursor stops and text may be entered. It the end of the buffer is reached at any time, a full-buffer message is displayed.
- Transmit Message Routine-This routine causes a scan of the message buffer for a zero byte. All text encountered during

111 100	polise lo a	1110110	ulopidy of	p. 0111,p. 1. 1
Program continued				
459C 9604 T COUNT	09169	LD	в,04н	;B=ADDR DIGI
	00170 WPKE:	CALL	002BH	;SCAN KEYBOA
RD 45Al B7	96199	OT		
	00180 00190	OR JR	A Z,WPKE	;WAIT FOR EN
TRY 45A4 FE08	00200	СР	ØØH	BACKEPACE E
NTERED?				
45A6 200E K BEX ENTRY	00210	JR	NZ,CFBO	; IF NOT, CHEC
45A8 3E84	00220	LD	A,04H	COMPLETE AD
DR ENTERED?	00230	CP	В	
45AB 20F1	90240	JR	Z,WFKE	; IF NOT, WAI
T FOR MORE	00250 INCB:	INC	В	;ADJUST DIGI
T COUNT	00260	LD	x 0.00	•ኮሮ፤ሮሞሮ ፣አፍጥ
45AE 3E00 ON CRT	00260	הם	А,00Н	;DELETE LAST
45B0 CD3300 45B3 2B	00270 00280	CALL DEC	0033H HL	;ADJUST ADDR
SAVE POINTER	10.0			
45B4 10E0 YBOARD SCAN	Ø0290	JR	WFKE	; CONTINUE KE
45B6 FE30	00300 CFHD:	CP	30H	; VALID HEX E
NTRY? 45B0 3F	00310	CCF		
45B9 D2CE45	00320	JP	NC,BADNUM	; IF NOT, DON
'T ACCEPT 45BC FE3A	00330	CP	3AN	; CHECK FOR Ø
-9 ENTRY	66246	CCP		
45BE 3F 45BF D2D945	00340 00350	CCF JP	NC,GZTN	;SAVE 0-9 EN
TRY 45C2 FE41	00360	CP	41H	;CHECK FOR I
LLEGAL ENTRY			71.7	, chuck ton I
45C4 3F 45C5 D2CE45	00370 00380	CCF JP	NC , BADNUH	;BAD ENTRY,
DON'T ACCEPT		_	·	
45C8 FE47 -F ENTRY	00390	CP	47H	; CHECK FOR A
45CA 3F 45CB D2D045	00400 00410	CCF JP	NC,GATF	;SAVE A-F EN
TRY				
45CE 18CE ANNING KEYS	00420 BADNUM:	JR	WPKE	; CONTINUE SC
45DØ CD33ØØ	00430 GATF:	CALL	0033H	DISPLAY A-F
ADDR DIGIT 45D3 E60F	89449	AND	ØPH	; A-F ASCII T
D BEX CONA	00450		a GOU	
45D5 C609 45D7 1005	00450 00460	ADD JR	A,09H SAVEHN	; SAVE HEX RE
SULT 45D9 CD3300	00470 GZTN:	CALL	0033H	:01SPLAY 0-9
ADDR DIGIT				;0-9 ASCII T
45DC E60F O HEK CONV	00400	AND	0FH	•
45DE 77	00490 SAVEHN:	LD	(BL),A	; SAVE HEX RE
SULT 45DF 23	00500	INC	RL	; INC ADDR SA
VE POINTER	00510	DJNZ	WFKE	GET REST OF
NEW ADDR				•
45E2 CD2B00 45E5 B7	00520 WFEK: 00530	CALL OR	002BR A	; SCAN KEYS
45E6 20FA	00540	JR	Z, WFEK	;WAIT FOR EN
TRY 45E8 FEØD	00550	CP	ØDH	; CR ENTERED?
45EA 2006	00560	JR	Z,PHN	; IF SO, PACK
HEX NIBBLES	00570	CP	0 0 H	;BACKSPACE E
NTERED? 45EE 20F2	00500	JR	NZ,WFEK	; IF NOT, SCA
7300 2002	20300	01/	HE FILL DA	Program continues

"A full buffer message is displayed after the last character is transmitted."

the scan is sent to the UART for transmission. If the entire buffer is full, a full-buffer message is displayed after the last character is transmitted.

- Basic Transmission Routine-Basic programs are stored in a compressed code format, starting at 42E9H. Programs can be entered from the keyboard in Level II Basic or from cassatte tape. This routine simply dumps the Basic buffer, starting at 42E9H, and continues until the end of the program, indicated by three zeros in sequence. A three A sync character is sent out for the receiving TRS-80 just before program transmission begins.
- Basic Reception Routine-This routine monitors the UART for a three A sync character. Incoming program bytes are stored in the Basic buffer starting at 42E9H. Three zeros in sequence indicate the end of the program.
- ●Terminal Routine-This routine controls UART operation. When a character becomes available, the UART receive buffer is read and the character is transferred to the display. When you make a keyboard entry, the UART transmit buffer is polled until empty, at which time the keyboard entry is transmitted.
- View/Change UART Configuration Routine-During program start-up hardware switches which contain UART programming data are read and stored in memory. Each time the UART is reconfigured, it is from this byte in memory that the configuration information is taken. The View/Change routine allows the user to read and modify this location under software control. ■

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Program continued		_			
N KEYS	0.05.00		~~		
45FØ 10BØ , GET ANOTHER	00590		JR	INCB	;DELETE LAST
45F2 21D946	00600	PHN:	LD	HL,MSHD	; SET UP ADDR
POINTER 45F5 AF	00610		XOR	A	;CLEAR ACC
45F6 ED6F	00620		RLD		;XCHANGE NIB
8LES (HL)<>ACC 45F8 7E	00630		LD	A,(HL)	;CET MS ADDR
NIBBLE 45F9 23				•	
INTER	00640		INC	HL	; INC ADDR PO
45FA 06 R 9YTE	00650		OR	(HL)	; PACK MS ADD
45F8 32D946 R 8YTE	0066D		LD	A, (DHRM)	;SAVE MS ADD
45FE 23 Inter	00670		INC	HL	; INC ADDR PO
45FF AF 4600 ED6F	00600		XOR RLD	A	;CLEAR ACC ;XCHANGE NIB
BLES (HL) <>ACC 4602 7E			LD	A (UT)	
NIØBLE 4603 23	00710			A,(HL)	CET LS ADDR
INTER 4604 B6			INC	HL	; INC ADDR PD
R BYTE	98720		DR	(HL)	; PACK LE ADD
4605 32DA46 R BYTE	99739		LD	(NSHD+1),A	; SAVE LS ADD
4608 21D946 POINTER	99748		LD	HL,NSHD	;SET UP ADDR
460B 7E 470F?	00750		LD	A, (HL)	; NEW ADDR >
460C FE47 460E 3F	00760 00770		CP CCF	47H	
460F D2DF46 DDR 0YTE <47	00780		JP	NC, ERRORA	; ERROR, NS A
4612 2802 K LS BYTE	00790		JR	Z,CLSBS	;MS=47, CHEC
4614 180C F8DA?	00000		JR	CUE	; NEW ADDR <
4616 23 INTER	00010	CLSBS:	INC	HL	; INC ADDR PD
4617 7E BYTE	00020		LD	A, (HL)	; GET LS ADDR
4610 FE0F 461A 3F	00030 00840		CP CCF	ØFH	;>0F?
4610 20 INTER	00050		DEC	HL	;DEC ADDR PO
461C DA3546	00860		JР	C, COFST	; IF LS ADDR
OK, GET OFFSET	00870		JP	ERRORA	; IF LS ADDR
BAD, ERROR 4622 FEP8	99999	CUE:	CP	0 F 8 H	;CHECK HIGH
ADDR 4624 3P	00090		CCF		i
4625 2005 HECK LS 0YTE	00900		JR	Z,CLSB	; IF MS OK, C
4627 DADF46 ERRDR	00910		JР	C, ERRORA	; IF MS BAD,
462A 1009 SET	00920		JR	COFST	;COMPUTE DFF
462C 23 INTER	00930	CLSB:	INC	HL	; INC ADDR PO
462D 7E	00940		LD	A, (HL)	; GET LS ADDR
BYTE 462E FEDØ TE	00950		CP	О D В Н	; CHECK LS BY
4630 3F	90960		CCF		
4631 DADF46 OR	00970		JP	C, ERRORA	; IF BAD, ERR
4634 2B Inter	00988		DEC	HL	;DEC ADDR PO
4635 56 SET ØETWEEN	00990	COFST:	LD	D,(HL)	;COMPUTE OFF
					Program continues

ogram continued				
1636 23	01000	INC	BL	; NEW ADDR AN
OLD ADDR				·
1637 5E		LD	E,(BL)	0. D.D. 1.00
1638 AF		XOR	A ATON	;CLEAR ACC
4639 210F47 DR		LD	BL,470FB	;LOAD OLD AD
163C EB 163D ED52		EX SBC	DE,HL HL,DE	;PERFORM SUE
TRACTION	01030	BBC	110,000	, rear own bot
463F 22DD46	0106B	LD	(DPPSET),HL	; SAVE OFFSET
4642 210F47 POINTER	01070	LD	HL,470PR	; SET OP ADDI
4645 7E BYTE	01000 EMB:	LD	A, (BL)	GET PROGRAM
4646 FE21 P CODES WITH	01090	CP	21B	; CHECK FOR (
4648 2829	01100	JR	Z,IBPl	; ADDRS THAT
MUST BE 464A PEll	01110	CP	11#	; MODIFIED, A
ND JUMP TO 464C 2825	01120	JR	z,IBP1	; RELOCATION
ROUTINE WHEN	01130	СР	32B	; PDUND
4650 2021	01140	JR	Z,IBPl	, I DOMD
4652 PE3A	01150	CP	3AH	
4654 201D	01160	JR	Z,IBPl	
4656 PECD	01170	CP	ØCDH	
4650 200B	01180	JR	NZ, TFCA	
465A 23 INTER	B119B	INC	RL	; INC ADDR P
465B 7E BYTE	01200	LD	A,(HL)	;GET PROGRA
465C FECD	01210	CP	ØCDH	;=CD?
465E 2803 ADDR POINTER	01220	JR	z, NOC	; JF SO, ADJ
4660 2B INTER	Ø123B	DEC	HL	; DEC ADDR P
4661 1010 ON ROUTINE	Ø124B	JR	IBP1	TO RELOCAT
4663 2B INTER	01250 NOC:	DEC	BL	;DEC ADDR P
4664 7E	01260	rD	A,(HL)	GET PROGRA
BYTE 4665 FECA	01270 TFCA:	CP	ØCAH	;=CA?
4667 200A	01280	JR	Z,IBP1	; IP SO, REI
CATE 4669 FEC3	81290	CP	ØC3B	;=C3?
466B 2006	01300	JR	z,IBPl	; IF SO, REI
CATE 466D FEC4	01310	CP	ØC4B	; =C4?
466F 2002	01320	JR	Z,IBP1	; IF SO, REI
CATE 4671 182A	01330	JR	IBP2	;FINISHED I
LOCATING? 4673 23	01340 IBP1:	INC	HL	; INC ADDR
INTER 4674 23	01350	INC	HL,	, INC ADDR
INTER 4675 7E	01360	LD	A, (HL)	GET MS ADI
BYTE 4676 FE43	01370	CP	43H	RELOCATE
>43	01380	CCF	75	, samoura
4670 3F 4679 D28946		JP	NC, CNB	OTHERWISE
CHECK NEXT	01400	AND	0F0H	; ISOLATE M
NIBBLE 467E FE40	01410	CP	40H	; IGNORE IF
OT=4X 4600 2802	01420	JR	Z,CSFADR	; 1F=4X, RE
CATE 4682 1885		JR	CNB	; CRECK NEX
BYTE 4684 CD8C46				:CALL RELO
4004 CD0C40	ATAMA CULUMK	· Cunp	Pr VDV	LOUGH WEEL



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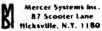
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			<u> </u>	
Program continued				
TION SUB 4687 1014	01450	JR	1000	5711741155 An
LOCATING?	D1436	JK	IBP2	;FINISHED RE
4609 28	01460 CNB:	DEC	BL	;DEC ADDR PO
INTER 468A 1889	01470	JR	ENB	CBECK IF RE
LO NECESSARY	01470	UN	EDD	CDECK IF KE
460C ED5BDD46	01400 SFADR	: LD	DE, (OFFSET)	; ADDR CBANGE
SUBROUTINE 4690 E5	01490	PUSE	HL	; SAVE ADDR P
DINTER				, 2, 2
4691 46	01500	LD	B,(BL)	; ADD OFFSET
TO PRESENT 4692 2B	01510	DEC	HL	PROGRAM ADD
R				,
4693 4E 4694 EB	01520 01530	LD EX	C,(HL) DE,HL	
4695 89	01540	ADD	BL, BC	FERFORM ADD
ITION	03550	5 2	DD 445	
4696 EB 4697 El	01550 01560	EX POP	DE,HL BL	RETRIEVE AD
DR POINTER		10.		,
4690 72	01570	LD	(HL),D	LOAD NEW AD
DR 4699 2B	01500	DEC	BL	
469A 73	01590	LD	(HL),E	
469B 23 469C C9	01600 01610	INC	HL	
469D 23	01620 IBP2:	RET INC	BL	; INC ADDR PO
INTER				
469E 3E4E LOCATING?	01630	LD	A,4EB	;FINISBED RE
46AØ BC	01640	CP	В	
46Al 2002 DDR BYTE	01650	JR	Z,CLSB1	CHECK LSD A
46A3 10A0	01660	JR	EM8	:IF MS BYTE
= 4E	01456			,
46A5 3E35 46A7 BD	81670 CLSB1 01600	: LD CP	A,35H L	;DONE IF LS
= 35	01000	Cr	L	DONE IF LA
46A0 2002 D NEW ADDR	01690	JR	Z,FHB	; IF SO, GO T
46AA 1899	01700	JR	EMB	; CONTINUE RE
LOCATION				
46AC 211C40 SCIAL OP CODES	01710 FRB:	LD	BL,481CH	; RELOCATE SP
6AF CD8C46	01720	CALL	SFADR	
46B2 21D94B 46B5 CD8C46	01730 01740	LD	BL,4BD9H	
46B8 ED5BDD46	01750	CALL LD	SFADR DE,(OFFSET)	GET OFFSET
46BC 210F47	01760	LD	BL,479FB	DETERMINE N
EW STARTING 16BF 19	01770	ADD	Dr. Dr.	- 1000
6CØ 1125Ø7	01700	LD	HL,DE DE,0725H	;ADDR ;LOAD PROGRA
LENGTH	61706			
66C3 19 EW ENDING ADDI	01790 ?	ADD	HL,DE	;DETERMINE N
46C4 EB	01000	EX	DE, HL	SET UP FOR
BLOCK TRANSFEI 46C5 Ø126Ø7		7.5	DO 93060	•
46C8 21344E	01810 01020	LD LD	BC,0726H BL,4E34H	
46CB EDBØ	01030	LDDB	==,,,==,,	; PERFORM BLO
CK TRANSFER 46CD 3AD946	91048	LD	A,(MSHD)	-CPM NEW CMA
RTING	71040	ш	n, (nanu)	GET NEW STA
46D0 67 46D1 3ADA46	01058	LD	B,A	; ADDR
46D4 6F	01060 01870	LD LD	A,(MSHD+1) L,A	
46D5 22DF40	01000	LD	(40DFB),HL	
46DØ E9 GRAM	01898	JP	(BL)	EXECUTE PRO
3094	01980 MSBD:	DEPS	4	; SET UP STOR
AGE 1002	41916 OPPOR		2	,
6DF 21E046	01910 OFFSET 01920 ERRORA	i: DEFS	2 BL,MSG2A	·PDDAD Meces
GE			·	; ERROB MESSA
16E2 CDA720 16E5 C39345	01930 01940	CALL	20A7B	
CATOR		JP	RELCON	; BACK TO REL
16E0 0D Le	01950 BSG2A	DEFB	adh	; MESSAGE TAB
16E9 49	81960	DEFM	'ILLEGAL ENTRY'	
16P6 ØD	01970	DEFB	ODH ENTRY	
46P7 ØØ	01900	DEFB	ØØB	



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				-
Program continued				
46F8 4E	01990 MSG1A	: DEFM	'NEW STARTING A	DDRESS?'
4700 00	02000	OEFB	ØDH	
470E 00	02010	DEFB	00H	
470F	02020	ORG	470FR	
	02030 ;****	****TERM	INAL PROGRAM****	****
470F 3EC9	02040 EMTER	M: LD	A,ØC9H	;LOAD RET IN
ST OP COOE				,
4711 320C48	82858	LO	(400CH),A	STORE RET I
NSTRUCTIONS	4.030	20	(40001, /11	, DIONE MEET
4714 320F40	02060	LD	(400pm) 3	ATM TIT DAM
	02000	LU	(400FM),A	;IN LII RAM
AREA	202			
4717 321240	02070	LD	(4012H),A	
471A 321340	02000	LD	(4013H),A	
4710 323540	02090	FO	(4035H),A	
4720 320040	02100	LO	(4000H),A	
4723 329540	02110	LO	(4095R),A	
4726 329848	02120	LO	(4098H),A	
4729 21A641	02130	LD	NL,41A6H	
472C Ø615	02140	LO	B,15H	
472E 77	02150 LOOP:		(HL),A	
472F 23	02160	INC		
			NL	
4730 23 4731 23	02170	INC	HL	!
	82180	1NC	NL	
4732 10FA	02190	ojnz	LOOP	CONTINUE LO
ADING RETS				
4734 210043	02200	LD	BL, EMTERM-40FH	; MESSAGE BUF
FER START				
4737 AF	02210 KOCM:	XOR	A	;CLEAR ACC
4730 77	02220	LD	(HL),A	; ZERO BUFFER
BYTE				
4739 23	02230	INC	RL	POINT TO NE
XT BYTE				, AV AN
473A E5	02240	PUSB	RL	SAVE POINTE
R		. 000	22	Anth tolling
4738 110F47	02250	LD	DE, EMTERM	. CEP TE AM P
ND OF BUFFER	92230	ш	DE, ENTERM	; SEE IF AT E
	22262	-		
473E EB	02260	EX	OE,HL	
473P AP	02270	· XOR	Α	_
4748 ED52	02200	- BBC	RL, DE	;SUBTRACT PO
INTER FROM EN		, - , -		
4742 2883	02290	7: JR	Z,PHL	;BUFFER FULL
IF Ø RESULT	02200	202	***	- DEMETEUR DU
4744 E1	02300	POF	HL	; RETRIEVE BU
FFER POINTER				
4745 18F0	02310	_{ç∈} JR	ROCM	; KEEP ZEROIN
G BUFFER	42224 BUT			
4747 El	02320 PHL:	POP	RL	; RETRIEVE BU
FFER POINTER	*****	OUT	(000)	
4749 D3E8	42330	001	(0E8H),A	RESET UART
474A DB29	02340	IN	A, (ØE9M)	; READ CONFIG
SWITCHES				
474C 32CF4D	02350	LO	(BUCR),A	; SAVE SWITCH
READING				
474F CD984B	02360	CALL	SRAPU	; RESET AND P
ROGRAM UART			_	
4752 CO5A4B	02370	CALL	SCHTCO	;CLEAR SCREE
N				
4755 210C4C	02380	LO	HL,MSGO	;DISPLAY EMT
ROL MESSAGE				
4750 COA728	02390	CALL	28A7H	
475B 21004C	02400	LĎ	RL,MSG20	;OISPLAY MEN
บ				
475E COA728	02410	CALL	29A7B	
4761 188C	02420	JR	WFMK	;WAIT FOR MO
NITOR REY				
4763 CD5A4B	02430 NON:	CALL	SCHTCO	CLEAR SCREE
N				,
4766 CD9B4B	02440	CALL	SRAPU	RESET AND P
ROGRAM UART			-	,
4769 21CB4C	02450	LD	RL,NSG10	;DISPLAY LYN
X MESSAGE				,
476C CDA728	02460	CALL	28A7H	
476F CD2B00	02470 WEMR:		002BB	SCAN KEYS
4772 B7	82488	OR	A	L DOING KUIN
4773 20FA	02490	JR		.WATE DOD DIE
TRY	2 W T J Y	O.A.	Z, WFMK	; WAIT FOR EN
4775 FE53	02500	CP	151	.TR 0 mo cm
ORE MESSAGE	46766	Ų.	D	; IF S, TO ST
4777 2822	02510	75	# CMOD=	. DOUBT
	02510	JR	z store	; ROUTINE
4779 FE52	02520	CP	'R'	; IF R, TO RE
CEIVE BASIC				
477B CA8348	02530	JP	Z,REC	; ROUTINE
477E PE50	02540	CP	1 X 1	; IF K, TO TR
ANSMIT BASIC				_
				Program continues

4708	continued CAE940 PE54	02550 02560		JP CP	Z,XHIT	ROUTINE; IF T, TO TE
4785	AL ROUTIN CAA549 FE56	02570 02500		JP CP	Z,TERM	; IF V, TO VI
	RANGE UAR CA4A4A	T 02590		JP	Z,VIEW	CONFIGURATI
ON 4780	FE42	02600		CP	181	•
N TO	BASIC CACCØ6				_	; IF B, RETUR
4792	FEIB OW, RETUR	02610 02620 N		JP CP	Z,06CCB 1BB	; IF SBIFT UP
4794 MENU	28C0	02630		JR	Z,MON	; TO MONITOR
	CD944B ESSAGE	02640		CALL	SERROR	;DISPLAY ERR
	16D4 R REY	02650		JR	WPMR	;WAIT FOR MO
	CD5A4B	02660	STORE:	CALL	SCBTCO	CLEAR SCREE
	21EB4D MENU	02670	STORE1:	LD	HL, MSG16	;DISPLAY MES
	CDA720 CD2B00	02680	GCTS:	CALL CALL	20A7E 002BH	
47A7		02700	GC13;	OR	A	; SCAN REYS
TRY		02710		JR	Z,GCTS	; WAIT FOR EN
ORE	PE53 ROUTINE	02720		CP	's'	; IF S, TO ST
47AE	2012 FE45 ROUTINE	02730 02740		JR CP	Z,STO	; IF E, TO ER
47B0	CA6F48	02750		JP	Z, ERA	
ARR	FELB OW, TO	02760		CP	1BE	; IF SHIFT UP
П	28AC	02770		JR	Z, MON	HONITOR MEN
TO !	FE60 Message	02780		CP	60H	; IF SHIFT 0,
47BB	20E0 CD944B	02790 02000		JR CALL	Z,STORE SERROR	; MENU ; DISPLAY ERR
	ESSAGE 10E4 Ry	02810		JR	GCTS	GET ANOTHER
47C0	CD5A4B	02020	STO:	CALL	SCETCO	CLEAR SCREE
47C3	210043 START	02030		LD	BL,EMTERM-40FH	; POINT TO BU
47C6 BYTE	7 E	B2040		LD	A,(EL)	GET BUPPER
FOR	FE00 MORE TEXT	02050		CP	00B	; IF 0, READY
47C9	2033 CD3300	02060 02870	DMR:	JR CALL	Z,CM 0033H	.DICDIAU NED
SAGE	CHARACTER	02800		CALL		DISPLAY MES
47D1		02090 02900		OR	002BH A	; SCAN REYS
ORTI	RUE			JR 	Z,CON1	; NO ENTRY, C
TO 1	PE60 Nessage	02910		CP	60H	; IF SRIFT 0,
47DØ	20C3 FE1B OW, TO	02920 02930		JR CP	Z,STORE 1BR	;MENU ;IF SRIFT UP
	2887	02940		JR	Z, MON	MONITOR MEN
47DC		02950	CON1:	INC	BL	; POINT TO NE
47DD TER	PPER BYTE F5	02960		PUSE	AP	; SAVE CHARAC
470E	E5	02970		PUSR	HL	; SAVE POINTE
	110747	02980		LD	DE, EMTERM	;SEE IP BUPP
ER Ft	EB	02990		EX	DE,BL	
47E3		03000 03010		XOR	A	CLEAR ACC
INTER	RFROM				BL,DE	SUBTRACT PO
ER		03020		JR	Z,BFM	; END OF BUPF
47E0		0303B		POP	HL	; RETRIEVE PO
						Program continues



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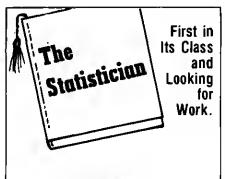
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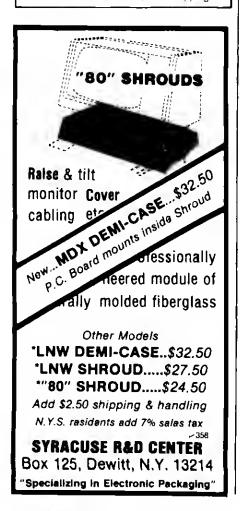
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ARACTER 47EA 7E	03050	LD	A, (HL)	GET CHARACT
ER INTO ACC 47EB FE00	03060	CP	00H	; IF Ø, CONTI
NUE ENTERING 47ED 200F	03070	JR	Z, CN	; HESSAGE
47EF 10DA RACTER	03080	JR	DMB	;DISPLAY CHA
47F1 E1 Inter	03090 BFM:	PDP	ĦL	;RETRIEVE PO
47F2 F1 ARACTER	03100	POP	AF	; RETRIEVE CH
47F3 CD5A4B N	03110	CALL	SCHTCO	;CLEAR SCREE
47F6 21114E FER FULL	03120	LD	HL, HSG19	;DISPLAY BUF
47F9 CDA728 47FC 18A8 SSAGE ROUTINE	03130 03140	CALL JR	20A7H STOREL	; HESSAGE ; TO STORE HE
47FE CD2B00 4001 B7	03150 CM:	CALL	002BB	; SCAN KEYS
4002 20FA	03160 03170	OR JR	A Z,CM	; IF NO ENTRY
, CONTINUE 4004 FE60 TO	03100	CP	6 D H	; IF SRIFT 0,
4006 2093 U	03190	JR	Z,STORE	; MESSAGE MEN
4000 FE1B ARROW, TO	03200	CP	108	; IF SHIFT UP
400A CA6347	03210	JP	z, mon	HONITOR MEN
400D FE08 E, DELETE LAS	03220	CP	00B	; IF BACKSPAC
400F 2002	03230	JR	NZ,CFIC	
4011 100D 4013 FE0D	03240 03250 CFIC:	JR CP	FHL ODH	; IF ENTER, P
LACE IN BUPFE! 4815 2006	03260	JR	Z,OKFB	
4017 PE20 R CNTRL CHARS	03270	CP	20H	; IGNORE OTHE
4019 3F 401A D2FE47	03200 03290	CCP JP	NC, CM	
401D 77 N BUFPER	03300 OKFB:	ĻD	(HL),A	PUT ENTRY I
481E 1011 ION IN BUFFER	Ø3310	JR	KHL	; CHECK POSIT
4020 2B TER	03320 FHL:	DEC	BL	; ADJUST POIN
4021 2B 4822 E5	03330 03340	DEC PUSH	RL BL	;SAVE POINTE
R 4023 2A2040	03350	LD	RL,(4020H)	GET CURSOR
POSITION 4826 AF	03360	XOR	A	CLEAR ACC
4827 11003C DR AT BEGIN-	03370	LD	DE,3CØØH	; SEE IF CURS
482A ED52 EEN	03300	SBC	HL,DE	; NING OF SCR
482C El FFER POINTER	03390	POP	RL	;RETRIEVE BU
402D 2091 NING, CONTINU	03400 E	JR	z,sto	; IF AT BEGIN
402F 3E08 ACE INTO ACC	03410	rD	A,08H	;LOAD BACKSP
4831 CD3300 CHARACTER	03420 KHL:	CALL	0033H	;DISPLAY ACC
4034 23 POINTER	03430	INC	HL	; INC BUFFER
4035 3600 BYTE	93449	LD	(EL),00H	ZERO BUFFER
4837 F5 TER	03450	PUSH	AF	; SAVE CHARAC
4030 E5 R	03460	PUSH	HL	;SAVE POINTE
4039 110F47 ND OF	03470	LD	DE, EMTERM	;SEE IF AT E
483C EB 483D AP	03400	EX	DE, HL	;BUFFER
403E ED52	03490 03500	XOR SBC	A BL,DE	;CLEAR ACC ;SUBTRACT PO
INTER FROM ENI	03510	JR	2,BFM	OF BUFFER
4842 E1 INTER	03520	POP	HL	RETRIEVE PO
				Program continues

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Program continued 4843 F1	03530	BOD.	B.D.	. DEMDYEUE CO
ARACTER		POP	AP	; RETRIEVE CH
4844 10BB TERING	03540	JR	CM	CONTINUE EN
4846 CD5A4B N	03558 TRA:	CALL	SCHTCO	CLEAR SCREE
4849 210043 FFER START	83560	LD	HL,EMTERM-48FH	; POINT TO BU
484C 7E BYTE	83570 CTT:	LD	A, (HL)	GET BUFFER
484D PE00 NISHED	83500	CP	00R	; IF ZERO, FI
484F 2815 4851 CD3388	03590 03600	JR C a ll	Z,RUART 8833H	-DIGHT BY DUD
FER BYTE 4854 CDAD48	83618	CALL		DISPLAY BUF
FPER BYTE 4857 CD1E4E	03620	CALL	STTC STRMC	TRANSMIT BU
RO 485A 23	03638			; WAIT FOR EC
405B E5	03648	INC	HL	INC POINTER
R		PUSH	HL PHECON	; SAVE POINTE
ND OF BUFFER	93659	LD	DE, EMTERM	;SEE IF AT E
4868 AF	03660 03678	EX XOR	DE,RL A	CLEAR ACC
4861 ED52 INTER PROM EN 4863 E1		SBC	HL,DE	SUBTRACT PO
4864 20E6 ND, CONTINUE	03690 03700	POP JR	HL NZ,CTT	OF BUFFER
	83710 RUART:	CALL	ERAPU	; RESET AND P
4869 CD5A4B	03720	CALL	SCHTCO	CLEAR SCREE
486C C3B249 MINAL MODE	03738	JP	TTU	BACK TO TER
486F 218943 FFER START	03748 ERA:	LD	HL, EMTERM-40FH	; POINT TO BU
4872 3600 8YTE	03758 KEB:	LD	(BL),08H	; ZERO BUFFER
4074 23	03768	INC	HL	; INC POINTER
4875 E5 THRU BUFFER	03770	PUSH	HL	; SEE IF ALL
4076 110F47 4879 EB	03788 03790	LD EX	DE, EMTERM DE, HL	
487A AF 407B ED52	03888 03810	XOR SBC	A HL,DE	;CLEAR ACC ;SUBTRACT PO
INTER FROM 407D El	83828	POP	HL	END OF BUFF
ER 407E 20F2	03830	JR	NZ,KEB	; KEEP ZEROIN
G BUFFER 4880 C39B47	03840	JP	STORE	; TO STORE RO
UTINE 4083 CD5A4B	03850 REC:	CALL	SCHTCO	;CLEAR SCREE
N 4886 CD2800	03860 WFAS:	CALL	8828H	SCAN KEYS
4889 87 488A 2887	03870 03880	OR JR	A 2,CSTRC	; IF NO ENTRY
, REC CHAR? 488C FE1B	83898	CP	188	; IP SHIFT UP
ARROW, TO 488E 2883	83900	JR	NZ,CSTRC	; MONITOR MEN
U 4890 C36347	03910	JР	MON	
4893 CDD44D HARACTER	83920 CSTRC:		STRBC	GET BASIC C
4896 FE41 REE A'S	83930	CP	'A'	; WAIT FOR TH
4098 20EC	03940	JR	NZ, WFAS	; IN SEQUENCE
489A CUD44D 489D PE41	83958 83968	CALL CP	STRBC	
489F 20E5	83978	JR	NZ, WFAS	
48A1 CDD44D 48A4 PE41	83988 83998	CALL	STRBC	
48A6 28DE	04800	CP JR	'A' NZ,WFAS	
48A8 21BC4D	94810	LD	BL,MSG17	DISPLAY REC
	· D		•	
EPTION MESSAG				
	84020 84030	CALL LD	28A7R HL,42E9H	; POINT TO ST

Program continued				
ART OF BASIC	94949 CRP:	CALL	STRBC	GET BASIC C
HARACTER 4884 FE00 RST OF THREE	04050	CP	99B	;LOOK FOR FI
48B6 2022 QUENCE	04060	JR	NZ,CFMS	; ZEROS IN SE
4080 77 CRARACTER	04078	LD	(BL),A	;SAVE BASIC
48B9 23 XT BUFFER BYT	94869	INC	HL	; POINT TO NE
48BA CD2C02 ISK	04090	CALL	22CB	;BLINK ASTER
40BD CDD44D ER	94199	CALL	STRBC	GET CHARACT
40C0 FE08 COND ZERO	94119	CP	09H	;LOOK FOR SE
48C2 2016	94129	JR	NZ, CFMS	; IN SEQUENCE
48C4 77 CHARACTER	04130	LD	(HL),A	; SAVE BASIC
40C5 23 XT BUFFER BYT	04140 E	INC	HL	; POINT TO NE
40C6 CDD44D BARACTER	04150	CALL	STRBC	GET BASIC C
40C9 FE00 IRD ZERO	04160	CP	00H	; LOOK FOR TH
40CB 200D	04170	JR	NZ, CFMS	; IN SEQUENCE
48CD 77 CHARACTER	04180	LD	(BL),A	; SAVE BASIC
48CE 23	04190	INC	HL	; INC POINTER
40CF 7D SIC ENDING	94208	LD	A,L	; SAVE NEW BA
40D0 32F940 40D3 7C	04210 04220	LD LD	(40F9B),A A,H	; ADDRESS
48D4 32FA40 48D7 C36347	04230 04240	LD JP	(40FAB),A MON	; BACK TO HON
ITOR MENU 40DA 77	04250 CFMS:	LD	(HL),A	;PUT BASIC C
HARACTER 40DB 23	04260	INC	HL	; INTO BUFFER
40DC CD2B00 40DF B7	04270 04200	CALL	002BH	; SCAN KEYS
40E0 20CF	04290	OR JR	A Z,CRP	; IF NO ENTRY
48E2 FE18 ARROW, TO	04300	CP	13H	; IF SHIFT UP
48E4 CA6347	04310	JP	Z,MON	; MONITOR MEN
48E7 18C8 CEIVING PROG	04320	JR	CRP	; CONTINUE RE
40E9 CD5A4B N	04330 XMIT:	CALL	SCNTCO	; CLEAR SCREE
40EC 21674D NSMIT MENU	04340	LD	BL,MSG12	;DISPLAY TRA
40EF CDA720 40F2 CD2B00	04350 04360 WFTLE:	CALL CALL	20A7H 002BN	; SCAN KEYS
40F5 B7 40F6 20FA	04370 04300	OR JR	A Z,WFTLE	;WAIT FOR EN
TRY 40F8 FE4C	04390	CP	, r	; IF L, TO LO
AD CASSETTE 48FA 200E 40FC FE54	84488	JR	Z,LOAD	; ROUTINE
ANSMIT ROUTING	04410 E 04420	CP	T MDANE	; IF T, TO TR
4900 FE1B ARROW, TO	04420 04430	JR CP	Z,TRANS 108	; IF SHIFT UP
4902 CA6347	94449	JP	Z,MON	; MONITOR MEN
4905 CD944B OR MESSAGE	04450	CALL	SERROR	;DISPLAY ERR
4900 10E8 TRY	04460	JR	WFTLE	;WAIT FOR EN
490A 218C4D SETTE MESSAGE	94470 LOAD:	LD	HL,MEG13	;DISPLAY CAS
490D CDA728 4910 CD2800	04400 04490 WFLK:	CALL CALL	20A7B 002BH	;SCAN KEYS
4913 87 4914 20FA	84588 84518	OR JR	A Z,WFLK	;WAIT FOR EN
			•	Program continues

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Program continued				
TRY 4916 FE4C	04520	CP	'L'	; IF L, TO LO
AD ROUTINE 4910 200A 491A FE18	04530 04540	JR CP	Z,LT 1BH	; IF SHIFT UP
ARROW, TO 491C CA6347	04550	JP	z, MON	: MONITOR MEN
U 491F CD944B	04560	-	SERROR	<i>'</i>
OR MESSAGE		CALL		DISPLAY ERR
4922 10EC TRY	04570	JR	WFLK	;WAIT FOR EN
4924 CD9302 SETTE	04580 LT:	CALL	293Н	TURN ON CAS
4927 0604 T FOUR BYTES	04590	ľD	B,04H	; IGNORE FIRS
4929 CD3502 ARACTER	04600 GTH:	CALL	235н	;GET TAPE CH
492C 10FB OP	04610	DJNZ	GTH	;COMPLETE LO
492E 21E942 ART OF BASIC	04629	LD	HL,42E9H	; POINT TO ST
4931 CD2800 4934 B7	04630 GNC: 04640	CALL OR	002ВН А	; SCAN KEYS
4935 200A , CONTINUE	04650	JR	Z,CON	; IF NO ENTRY
4937 FE1B ARROW, TO	04660	CP	1BH	; IF SHIFT UP
4939 2006 U	04670	JR	NZ,CDN	; MONITOR MEN
4938 CDF001 SSETTE	04600	CALL	1FØH	;TURN OFF CA
493E C36347 MENU	04690	JP	MON	;TO MONITOR
4941 CDA748 ARACTER	04700 CON:	CALL	STGC	GET TAPE CH
4944 A7 QUENCE?	04710	AND	A	;1ST Ø IN SE
4945 20EA ARACTER	04720	JR	NZ, GNC	GET NEXT CH
4947 CD2C02 ASTERISK	04730	CALL	22CH	;ZERO, BLINK
494A CDA74B ARACTER	04740	CALL	STGC	GET TAPE CH
494D A7 QUENCE?	04750	AND	A	;2ND Ø IN SE
494E 20E1 ARACTER	04760	JR	NZ,GNC	;GET NEXT CH
4950 CDA748 ARACTER	04770	CALL	STGC	GET TAPE CH
4953 A7 QUENCE?	04780	AND	A	;3RD Ø IN SE
4954 20DB ARACTER	04790	JR	NZ,GNC	GET NEXT CH
4956 7D DING ADDRESS	04000	LD	A,L	; SAVE NEW EN
4957 32P940 495A 7C	04010	LD	(40F9H),A	
495B 32FA40	04020 04030	LD	A,H (40FAH),A	
495E CDP001 SSETTE	04040	CALL	1F0H	;TURN OFF CA
4961 1806 MINI MENU	04850	JR	XMIT	;TO TRANSMIT
4963 21AB4D NSMIT MESSAGE	04060 TRANS:		HL,MSG14	;DISPLAY TRA
4966 CDA728 4969 218942	04070 04000	CALL LD	20A7H HL,42E9B	; POINT TO ST
ART OF BASIC 496C 0603	04090	LD	в, 03н	;SEND THREE
	04900 KSA:	LD	A,'A'	
4970 CDAD48 ARACTER	04910	CALL	STTC	;TRANSMIT CH
4973 10P9 OP	04920	DJNZ	KSA	;COMPLETE LO
4975 CD2800 4970 87	04930 CFMR: 04940	CALL OR	0028H A	;SCAN KEYS
4979 2005 RANSMIT CHAR	04950	JR	Z,TRCH	; NO ENTRY, T
	04960	CP	1вн	; IF SHIFT UP
	04970	JP	MON	; MONITOR MEN
4900 7E	04900 TRCH:	LD	A, (HL)	GET BASIC C



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Program continued				
49E1 32D240 49E4 F1	Ø546Ø Ø547Ø	LO POP	(PRINT),A AF	- DEMOT DVD ON
ARACTER 49E5 101B	05400	JR	RFU	; RETRIEVE CH ; CHECK FOR R
ECEIVED CHAR 49E7 F1	Ø549Ø GA8:	POP	AF	
ARACTER 49E8 FE18	05500 CFRTM:			; RETRIEVE CH
ARROW, TO		CP	1вн	; IF SHIFT UP
49EA CA6347	05510	JР	Z, MON	;HONITOR MEN
49ED FE01 O 0'S ROUTING		CP	01 H	; IF BREAK, T
49EF 283F 49F1 FE19 TO TRANSMIT	05530 05540	JR CP	Z,8REAK 19H	;IF SHIFT->,
49F3 CA4648 TINE	05550	JP	Z,TRA	;MESSAGE ROU
49F6 FE1F O CLEAR SCREI	Ø556Ø En	CP	lfh	; IF CLEAR, T
49F0 2005 49FA CD5A4B N	05570 05500	JR CALL	NZ, NCO SCHTCO	;ROUTINE ;CLEAR SCREE
49FD 1003 ECEIVED CHAR	05590	JR	RPU	; CHECK FOR R
49FF CDAD4B ARACTER	05600 NCD:	CALL	STTC	;TRANSMIT CH
4A02 CDB04B ECEIVED CHAR	05610 RFU:	CALL	STRC	; CHECK FOR R
4AØ5 87 4AØ6 2ØAA N KEYS	Ø562Ø Ø563Ø	OR JR	A Z,TTU	;BACK TO SCA
4A08 P5 EO CHARACTER	Ø564Ø	PUSH	AF	;SAVE RECEIV
4AØ9 89 AR SENT?	05650	CP	С	; CNAR REC=CH
4AØA 28Ø2 IF CNTRL CHAR	05660	JR	z,sicc	; IF SO, SEE
4AØC 1811 RINT ENABLE	05670	JR	TFP	; CHECK FOR P
4A0E FE20 CHARACTER, WA	05680 SICC: S	CP	20H	; IF CONTROL
4A10 300D 4A12 3AD34D 4A15 87	05690 05700 05710	JR LO	NC, TFP A, (CONTRL)	;IT ECHOEO?
4A16 2807 RE IT	05720	OR JR	A Z,TFP	; IF SO, IGNO
4A10 F1 4A19 AF	05730 05740	POP	AP	
4A1A 32D34D	05750	XOR LD	A (CONTRL),A	;CLEAR CONTR
L LOCATION 4Ald 1093	Ø576Ø	JR	TTU	;BACK TO SCA
N KEYS 4Alf 3AD240 ENABLED, PRIN	05770 TFP:	LD	A, (PRINT)	; IF PRINTER
4A22 87 ARACTER	05780	OR	A	;INCOMING CH
4A23 2805	05790	JR	Z, TDO	
4A25 F1 4A26 32E037	05800 05010	POP LD	AF (37EØH),A	
4A29 F5 4A2A F1	05820 05030 TDO:	PUSH POP	AP AF	
4A2B CD3300 OMING CHAR	05040	CALL	0033н	;DISPLAY INC
4A2E 1882 N KEYS	05050	JR	TTU	;BACK TO SCA
4A30 3ACF40 OUTPUT PORT	05860 BREAK:	LD	A, (HUCR)	;ZERO SERIAL
4A33 E6FB TIME TO	05870	AND	ØFBN	;FOR A SHORT
4A35 O3EA EAR SIGNAL	05880	OUT	(ØEAH),A	;GENERATE BR
4A37 21PPPF NE	05890	LO	HL,ØFFFFH	; OELAY ROUTI
4A3A 2B L UNTIL	05900 GDLY:	DEC	нг	;DECREMENT H
4A3B 7C	05910	LD	А,Н	;ZERO RESULT
4A3C B5 4A3O 20FB	Ø592Ø	OR	L No. ontw	
4A3F 3ACF4D	Ø593Ø Ø594Ø	JR LD	NZ,GDLY A,(HUCR)	;ENASLE SERI
AL OUTPUT PORS	05950	AND	0F8H	
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- •Fine tune springs
- •Check existing springs •Calculate wire size
- •Calculate rate
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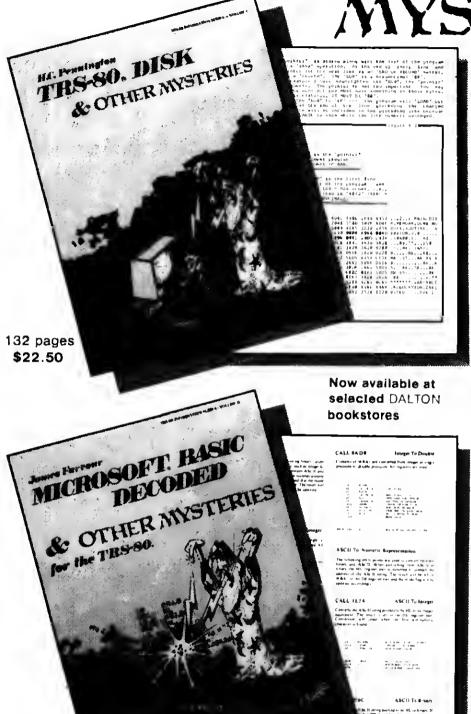
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Program continued				
4A44 F6D5	Ø596D	OR	Ø5H	
4A46 D3EA	05970	DUT	(ØEAH),A	
4A40 10B0	05900	JR	RFU	; CHECK FOR R
EC CHAR 4A4A CD5A4B N	Ø5990 VIEW:	CALL	SCHTCO	;CLEAR SCREE
4A4D 21484C	Ø 6889	LD	HL, HSG1	;DISPLAY MEN
4A58 CDA728	Ø6818	CALL	28A7H	
4A53 21CF4D ONTROL LOC	96020	LD	HL, HUCR	;READ UART C
4A56 CB5E Y & DISPLAY	06030	BIT	3,(HL)	;CHECK PARIT
4A58 2014 N, OR NONE	06840	JR	NZ,DISMSG	; IF ODD, EVE
4A5A CB7E	06850	BIT	7,(HL)	
4A5C 2000 4A5E 21554C AY	06060 06070 OMSG:	JR LD	NZ,EHSG HL,MSG3	;"ODD" DISPL
4A61 CDA728	06000	CALL	28A7H	
4A64 180E	06090	JR	CCMEG1	Saugus prop
4A66 21594C LAY	06100 EMSG:	LD	HL, MSG4	; "EVEN" DISP
4A69 CDA728 4A6C 1886	06110 06120	CALL JR	28A7H CCNSG1	
4A6E 214C4C LAY	06130 DISMSG:		HL, HSG2	;"NONE" DISP
4A71 CDA728	96148	CALL	28A7H	
4A74 CD6A4B RED?	06158 CCMSG1:		SCMSG	; CHANGE DESI
4A77 B7 4A78 2838	06160 06170	OR JR	A Z,WLMSG	; IF NOT, DIS
PLAY WD LENGT	гн Ø6188	CP	9AAR	; IF AA, TO N
ONITOR MENU 4A7C CA6347	06190	JP	Z,MON	
4A7F 216E4C ITY CHOICES	D6288	LD	HL,MSG6	;DISPLAY PAR
4A82 CDA728 4A85 CD2B00	06210 06220 NPS:	CALL	28A7H ØD2BH	;WAIT FOR O,
E, OR N 4A00 B7	Ø6238	OR	A	;OR SHIFT UP
ARROW 4A89 28FA	06248	JR	Z,NPS	
4A8B 21CF4D 4A8E FE4F	96258 96269	LD CP	HL, HUCR	; IF "O", SET
ODD				; IF 0 , 3E1
4A98 2812 4A92 FE45	Ø6278 Ø6288	JR CP	z,ois 'E'	; IF "E", SET
EVEN 4A94 2814	06298	JR	Z,EIC	
4A96 FE4E NO PARITY	06300	CP	'N'	; IF "N", SET
4A98 2816	86318	JR	Z,DIC	
4A9A FE1B ARROW, TO	86328	CP	1BH	; IF SHIFT UP
4A9C CA6347	86338	JP	Z, MON	; MONITOR HEN
4A9F CD944B OR MESSAGE	06348	CALL	SERROR	;DISPLAY ERR
4AA2 18E1 OTHER ENTRY	06358	JR	NPS	; WAIT FOR AN
4AA4 CBBE PARITY	86360 OIS:	RES	7,(HL)	; SET UP OOD
4AA6 CB9E 4AA8 1808	8637Ø 8638Ø	RES JR	3,(HL) WLMSG	;TO WL DISPL
AY 4AAA CBFE	86390 EIC:	SET	7,(HL)	; SET UP EVER
PARITY 4AAC CB9E	06488	RES	3,(RL)	
4AAE 1882 AY	86418	JR	WLMSG	;TO WL DISPL
4ABØ CBDE ITY	86420 DIC:	SET	3,(RL)	;DISABLE PAR
4AB2 219B4C D LENGTH	06430 WLMSG:	LD	HL, HSG8	;DISPLAY WDR
4AB5 CDA728 4AB8 3ACF4D	86448 06458	CALL LĐ	20A7H A,(HUCR)	;READ UART C
DNTROL LOC 4ABB E660	86468	AND	69H	; ISOLATE WL
BITS 4ABD FE00	06470	CP	00H	; IF 5 BITS,
DISPLAY				Program continues
		-		

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Program continued				
4ABF 2004	06480	JR	NZ,CF7	
4AC1 3E35	06490	LD	A, 151	
4AC3 1012	06500	JR	DIS 208	; IF 7 BITS,
4AC5 FE20 DISPLAY	06510 CF7:	CP	200	,11 , 5115,
4AC7 2004	06520	JR	NZ,CF6	
4AC9 3E37	06530	LD	A, 171	
4ACB 100A	06540	JR	DIS 40B	; IF 6 BITS,
4ACD FE40 DISPLAY	06550 CF6:	CP	- ORE	,11 0 2110,
4ACF 2004	06560	JR	NZ,MB0	ì
4AD1 3E36	06570	LD	A,'6'	
4AD3 1802	06500	JR LD	DIS A,'0'	;DISPLAY 0 B
4AD5 3E30 IT WL	06590 MB0:	טט	., u	,
4AD7 CD3300	06600 DIS:	CALL	0033B	
4ADA CD6A4B	06610	CALL	SCMSG	; CHANGE WORD
LENGTH? 4ADD B7	06620	OR	A	
4ADE 2844	96639	JR	Z,SBMSG	; IF NOT SHOW
STOP BITS				77 11 MO W
4AE0 FEAA	06640	CP	ØAAB	; IF AA, TO M
ONITOR MENU 4AE2 CA6347	06650	JP	Z,MON	
4AE5 21AB4C	06660	LD	HL,MSG9	DISPLAY WOR
D LENGTH			00000	;CHOICES
4AE8 CDA728	06670	CALL CALL	20A7H 002BB	WAIT FOR SE
4AEB CD2B00 LECTION OR	06600 WFWL:	CUUU	00200	
4AEE 21CF4D	06690	ľD	BL, HUCR	; RETURN TO M
ONITOR MENU	00700	O.F.		
4AF1 B7 4AF2 20F7	06700 06710	OR JR	a Z,WFWL	
4AF4 FE35	06720	CP	151	; IF "5", SET
UP		_		
4AF6 2828	06730	JR C P	Z,FIV '6'	; IF "6", SET
4AF0 PE36 UP	06740	CF	U	,21 0 , 551
4AFA 201E	06750	JR	Z,SIX	
4AFC FE37	06760	CP	'7'	; IF "7", SET
UP 4AFE 2814	06770	JR	Z,SEV	
4B00 FE30	06700	CP	101	; IF "0", SET
UP		-		
4B02 200A	06790	JR	Z,EIG	TR CUTRE UR
4804 ££18	06000	CP	18H	; IF SHIFT UP
ARROW, TO 4B06 CA6347	06010	JP	Z, MON	MONITOR MEN
U		•-	••••	Ī
4B09 CD944B	06020	CALL	SERROR	DISPLAY ERR
OR MESSAGE 4BØC 10DD	Ø6 03 Ø	JR	WFWL	; WAIT FOR AN
OTHER ENTRY	00030	UK	***************************************	, m. 12 . C
	06840 EIG:	SET	6,(HL)	;SET UP Ø BI
T WL	2000		F (05)	
4B10 CBEE 4B12 1010	Ø6 05 0 Ø6 06 Ø	SET JR	5,(BL) SBNSG	
4B14 CB86	06070 SEV:	RES	6,(BL)	SET UP 7 BI
T WL				
4816 CBEE	Ø688Ø	SET	5,(BL) SBMSG	ļ
	06090 06900 SIX:	JR Set	6,(HL)	SET UP 6 BI
T WL				•
4B1C CBAE	06910	RES	5,(HL)	
481E 1004 4820 CBB6	06920 06930 FIV:	jr Res	SBMSG 6,(HL)	; SET UP 5 BI
T WL	DOJJU FIV:	Keo	0,(111)	,551 01 3 51
4B22 CBAE	06940	RES	5,(RL)	
4824 218B4C	06950 SBMSG:	LD	HL,MSG7	;DISPLAY STO
P BIT MESSAGE 4B27 CDA728	06960	CALL	28A7H	
4B2A 21CF4D	06970	LD	BL, BUCR	;READ UART C
ONTROL LOC	Ac opa	DIM	A / 1973	; ISOLATE STO
482D CB66 P BIT BIT	06980	BIT	4,(BL)	JIBOHATE BIO
4B2F 2007	06990	JR	NZ,TSB	
4831 3E31	07000	LD	A, 11	; IF "0", DIS
PLAY 1 4B33 CD3300	07010	CALL	ØØ33н	
4B36 1805	07020	JR	CCMSG2	'
4830 3E32	07030 TSB:	LD	A, 121	; IF "1", DIS
PLAY 2	47440	0111	002211	
4B3A CD3300 4B3D CD6A4B	07040 07050 CCMSG2	CALL: CALL	0033H SCMSG	; CHANGE DESI
RED?				Program continues

Program sentiminal				
Program continued				
4B40 B7	07060	OR	A	
4B41 CA6347	07070	JF	Z, MON	; IF 00 OR AA
, TO MON-			• • • • • • • • • • • • • • • • • • • •	711 UU OK FAR
4B44 PEAA	07000	CP	ØAAH	:ITOR MENU
4B46 CA6347	07090	JР	Z,MON	
4B49 21CF40	07100	LD	HL, NUCR	; CHANGE # OF
STOP BITS 4B4C CB66	92339			
4 OF UART	07110	BIT	4,(HL)	CHANGE BIT
4B4E 2005	07120	70		
ATION	0/120	JR	Z,SR4	; CONTROL LOC
4B50 CBA6	07130	RES	4 /1101	
4B52 C36347	07140	JF	4, (RL)	
ITOR MENU	-,2.0	UF	HON	; BACK TO MON
4B55 CBE6	07150 SB4:	SET	4,(HL)	
4B57 C36347	07160	JP	MON	
4B5A 3E1C	07170 SCRTC	D: LD	A,1CH	CLEAD ECDES
N, HOME CURSO	R		nyion	CLEAR SCREE
4B5C C03300	07100	CALL	0033H	SUBROUTINE
4B5P 3E1P	07190	ro	A, 1PH	ADDROGITME
4B61 C03300	07200	CALL	0033R	
4B64 3E0E	07210	LO	A, ØEH	
4B66 CD3300	07220	CALL	0633H	
4B69 C9	07230	RET		
4B6A 215E4C	07240 SCMSG:	: LO	HL,MSG5	OISPLAY CHA
NGE QUESTION 4B6D CDA728	47054			
4B70 CD2B00	07250	CALL	28A7R	
OR Y, N,	07260 WFCA:	CALL	002BH	; SCAN KEYS F
4B73 B7	07270	OD	•	
RIFT UP ARROW	01210	OR	A	ENTER, OR S
4B74 20FA	07200	JR	7 MDCs	
4B76 PE4E	07290	CP	Z,WFCA 'N'	** **
ACC	0,230	CF	- M -	; IF N, ZERO
4B70 2011	07300	JR	Z,ZACC	
4B7A PEØO	07310	CP	ØDH	. TP DUMBO #
ERO ACC			V D 13	; IF ENTER, Z
4B7C 2000	Ø732Ø	JR	Z,ZACC	
4B7E FE59	07330	CP	ΙΥΊ	; IF Y, ACC =
PP			_	, 11 1, ACC =
4B00 280C	07340	JR	Z, SACC	
4B02 PE1B	07350	CP	1BH	; IF SHIFT UP
ARROW, ACC=A				,
4B04 280B	07360	JR	Z,RTM	
4B06 CD944B	07370	CALL	SERROR	;DISPLAY ERR
OR MESSAGE 4B09 1-8E5	02200			
TRY	07300	JR	WFCA	; WAIT FOR EN
4B8B 3E88	07390 ZACC:	t D	* Gan	
N=NO	DIJJO AACC:	LD	А,00н	;00 ON RETUR
4BØD C9	0740B	RET		
4B0E 3EFF	07410 SACC:	LD	A, OFFH	. PE ON DEMUD
N=YES		45	Ayorra	;FF ON RETUR
4B90 C9	07420	RET		
4B91 3EAA	07430 RTM:	LD	A, ØAAH	; AA DN RETUR
N=RETURN TO			,	, a. D. Reick
4B93 C9	87448	RET		; MONITOR MEN
U				,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
4B94 215840	07450 SERROR	: LD	HL,MSG11	; SUBROUTINE
TO DISPLAY	05 4 cc			
4B97 CDA720	07460	CALL	20A7H	; ILLEGAL ENT
RY ON CRT	07.47.0			
4B9A C9 4B9B D3E8	07470	RET		
TO RESET	07400 SRAPU:	OUT	(BEBH),A	; SUBROUTINE
4B90 3ACF4D	07490	t D	* (1)((CD)	**** ======
UART	D/43D	LD	A, (HUCR)	; AND PROGRAM
4BAØ E6F8	07500	AND	ØFØH	- BDON MOTOTY
G LOCATION	2,300	AND	Druk	;FROM HOLDIN
4BA2 F605	07510	OR	Ø5R	
4BA4 D3EA	07520	OUT	(ØEAH),A	
4BA6 C9	07530	RET	,, y	
4BA7 C03502	07540 STGC:	CALL	235R	; SUBROUTINE
TO GET CHAR				
4BAA 77	07550	LD	(HL),A	; FROH CASSET
TE TAPE				
4BAB 23	07560	INC	HL	;AND IHC BUF
FER POINTER	47576	D		
4BAC C9 4BAD 4F	07570 07500 comc.	RET	C 1	w
TO TRANSHIT	07500 STTC:	LD	C,A	; SUBROUTINE
	07590 WFU:	IN	A /GEAUL	.CUlbicmon -
N ACC	-/335 HEU!	TM	A,(ØEAH)	; CHARACTER I
				Program continues



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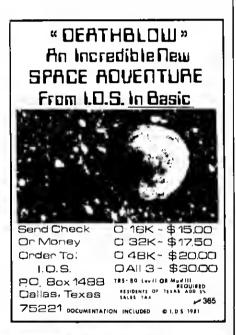


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Appa Cp33	ancaa	avm	<i>c</i>	- WAYM BOD PM
4BB0 CB77 PTY TRANSMIT	07600	BIT	6 , A	;WAIT FOR EM
4BB2 28PA	07610	JR	z,wfu	; BUFFER
4884 79 4885 D3EB	07620 07630	LD OUT	A,C (ØEBH),A	;TRANSHIT CH
ARACTER			(5222, 71.	,
4887 C9 4888 DBEA	07640 07650 STRC:	RET IN	A,(ØEAE)	; SUBROUTINE
TO RECEIVE		214	n, (vann)	, 500,000,110
40BA 32D04D FROM UART	07660	LD	(BUSR),A	; CHARACTERS
4BBD CB7F	07670	BIT	7,A	;TEST FOR RE
C CHAR READY 488F 2828	07600	JR	z, RETWZ	; RETURN IF N
OT				·
4BC1 DBEB ER 4BC3 P5	07690	IN	A, (ØEBB)	GET CHARACT
4BC4 3AD14D	07700 07710	PUSR LD	AF A,(ERROR)	; SEE IF ERRO
R DISPLAY ON	a222a	OD		
4BC7 B7 4BC8 2007	07720 07730	OR JR	A NZ,DISOAT	; IP NOT, DIS
PLAY CBARACTE	R		·	
4BCA 3ADØ4D ART STATUS	07740	LD	A, (BUSR)	GET SAVED U
4BCD E630 OR BITS	07750	AND	3 8 H	; I SOLATE ERR
4BCF 2012 , FIND ERROR	07760	JR	NZ, ERR	; IP NON-ZERO
4BD1 F1	07770 DISDAT	POP	AF	; RETRIEVE CH
ARACTER 4BD2 E67P	07700	AND	7FB	STRIP OTH B
IT 4BD4 FE60	07790	CP	60H	; IF SMALLS,
CHANGE TO CAP 4BD6 3F	S 07800	CCF		
4BD7 D2DC4B	97010	JP	NC,CFLF	
4BOA CBAF	07820	RE5	5,À	
4BDC FEBA D, IGNORE	07030 CFLF:	CP	ØAB	; IF LINE FEE
4BDE 2801 ACC = 0	07040	JR	Z,RETWZ	; RETURN WITH
4BEØ C9	07850	RET		
4BE1 AF 4BE2 C9	07060 RETWZ:	XOR RET	A	;CLEAR ACC ;RETURN
4BE3 21DØ4D	07800 ERR:	LD	HL, HUSR	READ SAVED
ERROR STATUS 4BE6 CB6E	07090	BIT	5,(BL)	; IF OVERRUN,
DISPLAY "O" 4BE0 C4F74B	07900	CATT	N7 OF	
4BEB CB66	07910	CALL BIT	NZ,OE 4,(BL)	; IF FRAMING,
DISPLAY "F"	87028	CATT		
4BED C4FD4B 4BFØ CB5E	07920 07930	CALL BIT	NZ,FE 3,(HL)	; IF PARITY,
DISPLAY "P" 4BF2 C4014C	Ø794Ø	CALL		TO DISPLAY
BAR			NZ, PAR	; TO DISPLAT
40F5 180E 4BF7 3E4F	07950 07960 OE:	JR LD	DISB A,'O'	*CO #O# 0401+
DE				;LOAD "O" CO
4BF9 CD3300 RACTER	07970 DEM:	CALL	0033H	;DISPLAY CHA
4BFC C9	Ø7900	RET		; RETURN
4BFD 3E46 DE	07990 FE:	ro	A,'F'	;LOAD "F" CO
48FF 18F8 RACTER	00000	JR	DEM	;DISPLAY CHA
4C01 3E50 DE	00010 PAR:	LD	A, 'P'	;LOAD "P" CO
4C03 10F4 RACTER	03020	JR	DEM	;DISPLAY CHA
4CØ5 3EAA DE	08030 DISB:	LD	A,ØAAH	;LOAD BAR CO
4C07 CD3300 RACTER	00040	CALL	0033H	;DISPLAY CHA
4CØA 10C5	00050	JR	DISCAT	
4C0C 2A *';HESSAGE	08060 HEGØ:	DEFM	'*** EMTROL SY	STEMS, INC. **
4C28 0D	00070	DEFB	ØDH	
4C29 20 4C3E 0D	00080 00090	DEFM DEFB	* *** LYNX	TLS ***'
4C3F 00	00100	OEFB	00B	
				Program continues

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Program continued				
4C40 8D	08110 HSG1:	DEFB	8DH	
4C41 58	08128	DEFM	'PARITY IS '	
4C4B 88	08138	DEFB	88H	
4C4C 44	00148 HSG2:	DEFM	'DISABLED'	
4C54 88	08150	DEFØ	80H	
4C55 4F 4C58 80	08160 HSG3: 08178	DEFM	ODD'	
4C59 45	Ø8188 MSG4:	DEFB DEFN	'EVEN'	
4C5D 88	08190 RSG4:	DEFB	80H	
4C5E 8D	08208 MSG5:	DEFB	8DH	
4C5F 43	Ø8218	DEFR	'CHANGE? (Y/N)'	
	Ø8228	DEF8	ØDH (1)	
	08238	DEFB	99H	
4C6E 8D	08248 MSG6:	DEFO	8DH	
4C6F 4E	Ø8258	DEFM	'NEW PARITY STA'	rus? (O/E/N)
4C89 0D	08260	DEF8	8DH	
4C0A 00	00278	DEFØ	99H	
4C88 0D	08280 HSG7:	DEFØ	8DH	_
4C8C 53	08298	DEFM	STOP BIT(S) =	'
4C9A 8Ø	08300	DEFØ	80H	
4C98 8D	08310 HSG0:	DEFB	8DH	
4C9C 57 4CAA 88	98329 98339	DEPH	WORD LEHGTH =	•
4CAB 8D	08348 MSG9:	DEFØ DEFØ	88H 8DH	
4CAC 57	08358	DEFH	'WORD LENGTH =	/ C / C / 7 / Q \ D T M
S?'	00330	DLFII	WORD BERGIN -	(3/6/1/0) 511
4CC9 8D	08360	DEFB	8DH	
4CCA 80	Ø837Ø	DEF8	80H	
4CCB ØD	00380 MSG10:	DEFB	8DH	
4CCC 2A	88398	DEFM	**** LYNX TLS **	k # !
4CDC ØD	08488	DEFB	ØDH	
4CDD ØD	Ø8418 HSG20:	DEF8	ØDR	
4CDE 53	88428	DEFH	'STORE MESSAGE	(S) '
4CEF 8D 4CF8 52	08438	DEFB	ODH PLANE	/=\ I
4DØ1 ØD	Ø844Ø Ø8458	DEFM	'RECEIVE BASIC	(н).
4D82 54	Ø846Ø	DEFØ DEFM	ODH TRANSHIT BASIC	(V) I
4D14 ØD	08478	DEF8	8DH	(A)
4D15 54	08488	DEFM	TERMINAL (T)	
4D21 ØD	98498	DEFB	9DH (T)	
4D22 56	08588	DEFM	'VIEW/CHANGE UAL	RT CONFIGURAT
IDN (V)'				
4D44 ØD 4D45 42	08518	DEF8	8DH	
4D56 8D	08528 08538	DEFM	'BACK TO BASIC	(B).
4D57 89	00548	DEFØ Defb	ØDH 8ØH	
4D58 49	08550 MSG11:	DEFH	'ILLEGAL ENTRY'	
4D65 8D	Ø8568	DEF®	8DH	
4D66 80	88578	DEF8	03H	
4D67 54	08500 HSG12:	DEFH	TRANSMIT BASIC	(ጥ) ፣
4D79 ØD	88590	DEFB	9DH	· - ,
4D7A 4C	98699	DEFM	'LOAD PROGRAM ()	L) '
4D8A 8D	08610	DEFØ	9DH	
4D0B 00	88628	DEFB	99H	
4D8C 0D 4D8D 52	00630 MSG13:	DEF8	ØDH	
4D98 8D	08648	DEFH	'READY CASSETTE'	
4D9C 48	08650 08660	DEF8 Defm	8DR	
4DA9 8D	Ø867Ø	DEFB	'HIT L TO LOAD'	
4DAA Ø8	Ø86Ø8			
4DAB 53	08690 HSG14:	DEFB Defh	SENDING BEDGEN	
4DBA OD	08700 HBG14:	DEFB	SENDING PROGRAM	1-
4D8B 00	00710	DEFØ	00H	
4DBC 52	88728 HSG17:	DEFM	RECEIVING PROGR	AM !
4DCD ØD	8873Ø	DEFB	8DH	d'M'i
4DCE Ø8	98749	DEFØ	98H	
8991	08758 HUCH:	DEFS	1	: TEMPORARY S
TORAGE	00760 0000			
0801	00760 HUSR: 00770 ERROR:	DEFS	1	
8881	88788 PRINT:	DEFS DEFS	1	
8081	88790 CONTRL:		1	
4DD4 CD2B80	00880 STROC:	CALL	0028H	; SUBROUTINE
TO RECEIVE				A MODROGITAE
4DD7 B7	00810	OR	A	BASIC CHARA
ADDO 2000	20000			, Quinker
4DD8 2888 4DDA FE1B	08820	JR	2,BCR	
ARROW, POP	08830	CP	10H	; IF SRIFT UP
4DDC 2084	08840	JR	N7 GCP	
ETURN TO			NZ, BCR	STACK AND R
4DDE C1	8850	POP	вс	;HONITOR MEN
U				,
				Program continues
				-3 55,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

4DDF C36347	00869	JP	MON	
4DE2 DBEA	00070 BC	R: IN	A, (@EAH)	WAIT FOR B
SIC CHARACTE	3		, (0 2 ,	JANTI LOK DI
4DE4 CB7F	00000	BIT	7.A	
4DE6 20EC	00090	JR	Z.STRBC	
4DE0 DREB	00900	IN	A, (0EBH)	GET BASIC
HARACTER			, (02011)	TODI DASIC (
4DEA C9	00910	RET		
4DEB ØD	00920 MS	G10: DEPO	ØDH	; MESSAGE TAG
LE				AUTODAGE IM
4DEC 53	00930	DEFM	'STORE MESSAGE	1811
4DFD ØD	00940	OEF0	ØDH	(3)
4DFE 45	00950	DEFM	'ERASE MESSAGE	(F) !
4EOF OD	00960	DEPB	ØDH	(1)
4E10 00	08970	DEPØ	00H	
4E11 0D	00900 MS	G19: DEF8	0DH	
4E12 42	00990	DEPM	'BUFFER FULL'	
4E1D 00	09000	DEFB	00N	
4ELE DBEA	09010 ST	RNC: IN	A, (ØEAH)	; SUBROUTINE
TO RECEIVE			, , ==,	, bobkool Ing
4E20 C07F	09020	TIS	7.A	MESSAGE CHA
RACTERS			·	ATTENDED CITY
4E22 2003	09030	JR	Z,CFRTMC	;WAIT FOR CE
ARACTER				, LOR C.
4E24 DBEB	09040	IN	A, (ØEBH)	: ECHO
4E26 C9	09050	RET		,
4E27 CD2B00	09060 CF	RTMC: CALL	0028H	SCAN KEYS
4E2A 87	09070	OR	A	, 55 1.222
4E20 20F1	09060	JR	Z,STRMC	: IF NO ENTRY
, CONTINUE				, ,
4E2D FE18	09090	CP	18H	; IF SHIFT UP
ARROW, TO				, == ==================================
4E2F 20ED	09100	JR	NZ, STRMC	; MENU, BUT F
IRST POP	•			,, 1
4E31 C1	09110	POP	ac	; STACK
4E32 C36347 Menu	09120	JР	MON	TO MONITOR
4590	09130	END	RELSRT	



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The students meet the POKE instruction.

Alternate Course—Part III

Michael A. Duffin 1507 East Avenue Berwyn, IL 60402

n most date processing courses, the atudent usually does not write any programs which might affect the system—especially a large system. Many large systems have enough trouble running without novice programmers experimenting with them. The TRS-80, on the other hand, is a one-on-one system, so the only person that is hurt by this type of experimentation is the programmer.

In my data processing class, I introduced the POKE instruction to illustrate graphics. There are three reasons I chose the POKE instruction rather than Set and Reset.

First, when using POKE for graphic representations the first operand must be a number between 15360 and 16383. These are the positions in memory (decimal) which control what is on the screen (i.e. POKEd characters in these positions are reflected on the screen). POKEing outside of this range will result in a variety of errors and in many cases Memory Size? will appear on the screen. When this occurs the user's program is lost. By usine POKE my students learn what is stored in memory by the operating system.

Second, an additional operand of the POKE instruction is the ASCII (American Standard Code for Information Interchange) representation of a character. Thus, when we talked about ASCII in class, the students hed a concrete example to refer to.

Third, when using the POKE instruction, six bits are set on the screen at once. With the Set instruction only one bit is set at a time. By the way, when you program a figure from a TRS-80 video display worksheet using POKE you must add 15360 to the numbers 0 through 1023 so the figure will appear on the corresponding positions on the screen.

Before we could begin representing graphics on the screen using POKE, the first thing we had to do was determine

which bit position combinations corresponded to what ASCII numbers. All the combinations are represented by ASCII numbers 129 through 191. I gave my students the following program to determine the correspondence between numbers and characters:

10 CLS

20 FOR A = 129 to 191

30 PRINT A " = " CHR\$(A)

40 PRINT

50 NEXT A

I elso gave them the following instructions with this program:

- Type this program in and run it.
- Add the necessary code to this program to slow it down so the character representations can be recorded.
- Record the character representations of 129 to 191 on a TRS-80 video display worksheet.
- Describe how this program works line by line.

The problem with this program is the characters flash by too fast to be recorded. If we add the lines.

42 FOR X = 1 to 250 44 NEXT X

the For...Next loop slows the program enough to record the characters. Should more time be needed, hit the Break key to stop the program. To continue, type in CONT and hit the Enter key.

In this program, line 10 clears the screen; lines 20 and 50 creete a loop starting with the number 129 end ending with the number 191. Line 40 prints a blank line between each character representation. Line 30 prints the current numeric value of A followed by an equal sign. The instruction CHR\$(A) prints the ASCII equivalent of the number A. For this problem all the ASCII equivalents are graphic characters.

Once my students had recorded all the graphic characters, I gave them the following program to type in:

50 POKE X, 32

60 POKE X+1, 32

70 POKE X, 176 80 POKE X+1, 190

90 POKE X + 2, 189

100 POKE X + 3, 178

110 NEXT X

120 GOTO 20

I then gave my students the following instructions:

- Enter this program and run it.
- Describe how the program works line by line.
- Remove the words STEP2 from line 20.
 How does this affect the program?
- Write a program that will cause the oblect to move in a different direction.

in the program a small flying saucer moves across the screen from left to right, top to bottom. The saucer is continuously erased and rebuilt so It appears to move across the screen. More specifically, the For. . . Next loop in lines 20 and 110 cause X to be incremented from 15361 to 16379. STEP2 causes this incrementation to be done be twos (i.e. 15362, 15364, 15366, etc.). Removal of STEP2 causes the saucer to move half as fast. Lines 30 through 60 erase the saucer. (i.e. the ASCII number 32 causes a six-bit graphic character to be erased). Lines 70 through 100 rebuild the saucer. This program is a little unusual because it starts with a non-existent figure being erased and then builds a figure. X is then increased by two, the previous figure is erased, the next figure is built, and so on, until X is greater than 16377.

As a further exercise I asked my students to write a program which would cause the saucer to move in three other directions. This isn't that simple because the sample program is not geared for many other directions. For example, if we wish the saucer to move from right to left, the For... Next loop is of little use in its present form. Thus, they first had to determine a set-up for the program that could be adaptable for any direction. The right to left example that follows illustrates this:

10 CLS

20 FOR X = 15362 to 18376 STEP2

30 POKE X - 2, 32

40 POKE X - 1, 32

10 CLS 20 X = 18379 30 GOSUB 1000 40 X = X - 1 50 IF X<15360 THEN GOTO 20



... the only person hurt by this type of experimentation is the programmer."

60 GOTO 30 1000 POKE X,178 1020 POKE X + 1,190 1030 POKE X + 2,189 1040 POKE X + 3,176 1060 POKE X,32 1070 POKE X + 1,32 1070 POKE X + 2,32 1080 POKE X + 3,32 2000 RETURN

In this program the subroutine at lines 1000 through 2000 cen be used no matter what direction the figure moves. The key to the movement is in lines 40 and 50. Line 40 decrements the value of X by one, end thus the saucer appears to move from right to left. Line 50 is necessary to keep the ship from going off the screen, and it also restarts the program when it reaches the end of the screen.

If we wish to move in another direction we only have to change lines 40 end 50. For exemple, if we wish to move from top to bottom in a left to right manner we would use the following:

> 40 X = X - 64 42 IF X + 3>16383 THEN X = X - 1023 50 IF X + 3 = 16383 THEN X = 15360

Line 40 writes X in the position directly below the previous X. Line 42 places the figure at the top of the screen after the figure has been printed at the bottom. The figure at the top is printed to the right of the previous figure at the bottom. If we wish the figure to be printed in a top to bottom, right to left menner, we need only substitute the following for line 42:

IF X + 3>16383 THEN X = X - 1025

Line 50 prints the figure at the upper left of the screen before if goes past the bottom right of the screen.

Now that we can get the figure to move in eny direction, it would be nice if we could switch directions et the push of a button. To do this we have to make use of the INKEY\$ instruction. As en introduction, I gave my students the following program and instructions:

10 CLS
100 PRINT 10:GOSUB 1000
110 OOTO 100
200 PRINT 20:GOSUB 1000
210 GOTO 200
300 PRINT 30:GOSUB 1000
310 GOTO 300
400 PRINT 40:GOSUB 1000
410 QOTO 400
500 PRINT 50:QOSUB 1000
510 GOTO 500
1000 FOR X = 1 TO 200;NEXT X
1010 IF INKEY\$ = "B" THEN GOTO 200

 Run the above program and hit the letter B. What heppens? Modify the progrem above so that lines 100, 200, 300, 400 or 500 get executed when a different letter is pressed.

• What does INKEY\$ do?

When the program is executed, the number 10 is written periodically until the letter B is hit. At this time the number 20 is printed.

Modifying the program is somewhat difficult. Due to a peculiarity of the INKEY\$ instruction, once it is accessed the value disappears. Thus, if we just used if statements between lines 1000 and 1100, only the first if statement would reflect the key that was depressed. If we want to check the depressed key more than once, we must use code similar to the following:

1010 B\$ = !NKEY\$
1020 IF B\$ = "A" THEN GOTO 100
1030 IF B\$ = "B" THEN GOTO 200
1040 IF B\$ = "C" THEN GOTO 300
1050 IF B\$ = "D" THEN GOTO 400
1060 IF B\$ = "E" THEN GOTO 500

By etoring the value of INKEY\$ within our program, we can access it as often as we like without it disappearing.

But now we need an If statement for every check we wish to make. To evoid this I introduced my students to the ON...GOTO instruction with the following changes in the program:

1000 FOR X = 1 TD 200:NEXT X 1010 ON VAL(INKEY\$) GOTD 100,200,300,400,500 1020 RETURN

The wey the ON...GOTO instruction works is more clearly explained if I use the following example:

DN X GDTD 100,500,200

If X = 1 then we go to line 100. If X = 2 then we go to line 500. If X = 3 then we go to line 200. If X has any other value, the next statement in the program is executed. In line 1010 we must use the VAL instruction because INKEY\$ gives us the ASCII equivalent of the number we have entered. By using VAL the ASCII characters are converted to numerics.

Now that we can move our figure in eny direction by hitting a key, there are a few other things we might desire if we want to make this program into a geme. First, we might want more than one figure on the screen. Second, we might went them to shoot at each other; and finally we must decide if the second figure will be controlled by another person or the computer.

The 13-line subroutine in Fig. 1 constructs e second figure whose movement is controlled by hitting the letters A,B,C or D. The values given to the W erray in conjunc-

tion with lines 3020 through 3050 and 3100 control the direction of the figure.

Line 3020 causes the letters A through D to be converted to the numbers one through four. Line 3020 subtracts 64 from the ASCII equivalent of the charecter depressed while the program is running. Since the ASCII equivalents of A,B,C and D are 65,66,67 and 68 respectively, this line gives variable B a value of one when A is depressed, two when B is depressed, three when C is depressed end so on. Line 3030 ellows only A through D to be depressed; all other letters set B to equal one. Line 3040 erases the figure.

Line 3050 causes Y to be incremented by a member of the array W. The values of this errey were established in line 12 along with the initial values of Y and B. The veriable B pointe to the correct element.

To illustrate this, let us assume that C was depressed while Y = 16005. Then line 3020 becomes:

B = ASC(C) + 64 which means B = 67 - 64 which means B = 3.

The If statement in line 3030 fells since B = three. Line 3040 erases the figure that started at Y = 16005.

Line 3050 translates to:

Y = 16005 + W(3) since W(3) = 64 from line 12 Y = 16005 + 64 Y = 16069.

The If statements in lines 3060 through 3090 re-esteblish Y if the value of Y extends beyond the range of the screen (i.e. 15360 to 16383). Line 3100 then builds the new figure et the desired location.

To put it more simply, if A is entered, the figure moves from right to left. If C is entered the figure goes down, end if D is entered the figure moves up.

Fig. 2 illustrates another version of this subroutine. In this version the computer controls the ship (varieble Y). The computer's ship chases enother ship (varieble X). In addition, the computer's ship fires upon the user'e ship (lines 3130 through 3200). With minor modifications both of these routines can be included within the same progrem. I suggest changing Fig.1 in the following menner:

- Change the line numbers.
- Change variable Y to X.
- Change Y = 16379 to X = 15360 in line 12.
- Change the variable B to another variable name (such as C).

By edding a couple of GOSUBS you'll have one ship chesing enother. However, since the user's ship doesn't shoot, you had better add a routine for this if you intend to win.



This program will lay-up your TRS-80 for more than three seconds.

Hoops

William Cornwell 609 Ellynn Drive Cery, NC 27511

Score! Doctor J adds two more!", exclaimed the talevision announcer. "Dad, how many points does Doctor J have now?" asked my 14-year old son. I couldn't tail him as I wasn't keeping score myself, but as I glanced up with my rasponse, I noticed our Lavel II 16K TRS-80 nearby, but not in operation.

What a great application—design a basketball scorakaaping program. So in the next few evenings I thought considerably about what would be required.

Tha mora I thought, the better the program appeared. First, I located a video display worksheet and panciled in the format of the output—team names, scores and fouls. I then provided lines for the individual players—numbers, names, number of fleid goals and fouls, total points scored, and number of parsonal fouls (see Photo 1). I discovered that a two-dimensional, 14-member array in Basic would handle all of this data nicely.

With the output out of tha way, I next considered the input date. One goal was to have the ability to correct any character keyed in error prior to antering the data, or provide a means of Ignoring the Input request from eny character position. Based on my Basic experience, this precluded the use of an INKEY\$ type of routine. Also, I wanted any Input combination to be one character string so the user would not have to continually key additional commas as field separators. This would also provide the flexibility of having one, two, and four-character input coding strings.

Naxt, I started to code the Basic program logic, but on paper first! This turned out to be well worth the affort as I was able to develop the total program in a subroutine fashion—optimizing statements as I coded—and using open boxes for GOTO

labal numbers. When the Basic coding was finished, I wrote the statement numbers down for both the Basic statements and then in the GOTO boxes.

Sinca I don't have the luxury of a printer, the paper draft provided outstanding reference material for debugging and cosmetic changes. And I made several of each.

The moment of truth arrived as I keyed Run. Concept was good, but I had to make several other minor adjustments for better viewing on the output display. I was quite happy with the results—the paper draft natted a nearly bug-free implementation! Numerical column elignment using Basic with combinations of single and double-

digit numbers was tha toughast problem. Scraan data is prasented in anywhere from one point five to three seconds depending upon the number of players.

After loading the program and keying Run to begin program initiation, the user is questioned whether or not he desires an explanation of the program and the instructions. Assuming the user wants this information, he keys a Y (for yes) and a description of the program is displayed.

He is than raquested to push the Enter key to continue program operation. The Halp scraen (see Photo 2) is displayed. The next logical function would be to load both a home team and a visiting team. Com-



Photo 1. Semple Output Reflecting Box Score of NBA finel Playoff Game Box Score (Player Fouls are Estimated).

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"What a great application— design a basketball scorekeeping program."

mands for each appear later.

The Enter Data? request appears at the bottom line of the screen es e result of: keying N (for no) to the information request during program initiation; pushing Enter efter viewing the program information and input coding structure display; the successful conclusion of a previously keyed input commend.

Since the Enter Date? request is where all the action occurs during the course of this progrem, a more detailed description of the input code structure follows. After keying any input code, the user pushes the Enter key to initiate program action for that code.

Valid single-character entries are:

?—I heve a question end need help—this will displey the input coding structure (the Help screen in Photo 2) that is acceptable to the Enter Data? request. D—Display—displays the team and pleyer totals.

X—Input keying error—this character eppeering in eny one of the four positions of the input code positions signels en input error and the user cen respond to another Enter Data? request.

E—Exit—exits or terminates the program.

Valid two-character entries are:

HA—Add player(s) to home team—user must enter a two-character number, push the Enter key, and then key a name of 12 cherecters or less and push the Enter key again. If no players' names exist, the user will be requested to key a team name with the same 12 characters or less limitation tollowed by the Enter key prior to entering any player information.

VA-Add player(s) to visiting team-same description as the HA code ex-

cept information applies to the visiting team.

Valid four-character entries are: * indicates that the first character will be either an H for a home team player or a V to indicate a visiting team player; the second character indicates what event occurred;



Photo 2. Sample of Help Screen Display.



"The program provides the basics for basketball scorekeeping and was a joy to develop."

the last two cheracters of NN represent the number of the player.

- *BNN-Basket scored-player NN scored a two-point field goal.
- *LNN-Long basket scored-pleyer NN scored e three-point field goal.
- *FNN-Foul shot successful-pleyer NN scored one successful free throw.
- *TNN-Two foul shots successfulplayer NN scored two successful free throws.
- *PNN-Personal foul-player NN has committed a personal foul.

The Help screen (see Photo 2) provides a concise listing for the above codes.

For those readers who do not cere about the internal data structure or have no intention of modifying the program, they should conclude with the summary paragraphs. As I stated earlier, the deta area for the program is a two-level, 14-member array for each field: player's number (A\$), player's name (B\$), number of field goals (J), number of successful foul shots (K), total points (L) and number of personal fouls (M).

Veriables N and P are used for updating the array fields: N is the level value-zero for the home team end a one for the visiting teem. This value is determined from the first character of the input coding structure. The variable P, when it ranges from one to 13, represents a pleyer value. When this variable is a zero it refers to a team value.

For instance, the name fleid, B\$ (0,0) or B\$ (1,0), refers to the team names. The field goal variable, J (0,0) or J (1,0), contains the number of players currently entered in the teem list (see Fig. 1). The total points field for the team contains the teem score, and the number of personal fouls field contains the number of team fouls. But this last value never exceeds seven for either team since seven will handle the foul bonus eltuations for ell levels of baskethell

în summarizing, I wented e useful, simple and meaningful code structure. The basketbell scorekeeping progrem, I think, meets these original objectives. In addition, the program, as is, applies to any level of basketball-professional, collegiete, scholastic, or non-scholestic. The program can also be used with severel of the commercial basketball games evallable such es Besket.

The program provides the basics for basketbell scorekeeping and was a joy to develop. Some possible enhancements include: Loeding the players' nemes and numbers via tape, disk or data statements; printing a final box score at the game's conclusion; saving player and team totals on some media for use with additional averaging-type programs; and, lastly, correcting any error once entered (points credited to the wrong player, disallowed baskets or fouls). I would be interested in copies of any such enhancements.

Field	Variabia	Team Information	Player information	
		P=0	P=1	P = 13
Player's number	A\$	-Not used-	Player's number	Player's number
Player's name	8\$	Team name	Player's name	Plåyer's name
Field goals made	J	Number of players on team	Player's field goals	Player's field goals
Fouls made	K	-Not used-	Player's fouls made	Player's fouls made
Total points	L	Team point total	Player's point point total	Player's point point total
Personal fouis	M	Team personal	Player's personal fouls	Player's personal louis

Fig. 1. Summary of Array Information (Home Team when N=0, visiting team when N=1).

Program Listing

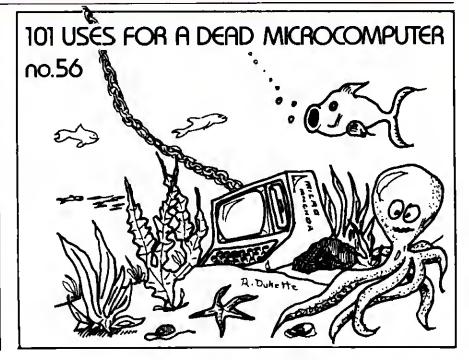
10 REM INITIALIZE AND SET MAXIMUM PLAYER LIMIT (P=13)

20 CLEAR 1000: P=13

30 DIMAS(1,P):DIMB\$(1,P):DIMJ(1,P):DIMI\$(2):DIMK(1,P):DIML(1,P): DIMM(1,P

40 CLS: PRINT@144, "BASKETBALL SCOREKEEPING PROGRAM"

Program continues



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Program continued

```
50 PRINT0351, "BY"
60 PRINT0536, "WILLIAM CORNWELL"
70 PRINT0600, "609 ELLYNN DRIVE"
80 PRINT0664, "CARY, N. C. 27511"
 90 PRINT: PRINT
100 REN TEST TO SEE IF INFORMATION WANTED
110 INPUT "INSTRUCTIONS NEEDED? KEY: Y/N"; XS:CLB
120 IF XS="N" THEN 100
138 REM GO SHOW THE INPORMATION SCREEN
148 GOSUB 1138
158 REN GO SHOW THE VALID CODE SCREEN
160 GOSUB 1270
178 REM MAIN PROGRAM LOGIC - ROUTINE RETURN POINT
100 XS="
198 PRINT@961, "ENTER DATA";: INPUT X$
 200 REM SET AND VALIDATE LENGTH OF RESPONSE
 210 N=LEN(X$):1P N=3 OR N>4 THEN PRINT@1000,"INPUT NOT 1.2 OR 4
 CHARS";:GOTO180
229 REM SEPARATE FIRST CHARACTER OF RESPONSE
 230 I$(1)=LEPT$(X$,1)
240 IP I$(1) = "X" THEN 180
250 IF N=1 THEN 340
 260 REM SEPARATE SECOND CHARACTER OF RESPONSE
260 REN SEPARATE SECOND CHARACTER OF RESPONSE
270 I$(2)=NID$(X$,2,1)
280 IF I$(2) = "X" THEN 180
290 REM AND GET THE FINAL TWO RESPONSE CHARACTERS
380 IF N>2 THEN I$(0)=NID$(X$,3,2)
310 IF NID$(X$,3,1) = "X" THEN 180
320 IF NID$(X$,4,1) = "X" THEN 180
330 REM VALIDATE PIRST RESPONSE CHARACTER
340 IP I$(1)="0" THEN 1850
350 IF I$(1) <> "H" THEN 380
360 REM HOME TEAM SET UP ARRAY VALUE
360 REM HOME TEAM SET UP ARRAY VALUE
370 N=0:GOTO 540
380 IP 15(1) <> "V" THEN 410
390 REM VISITING TEAM SET UP ARRAY VALUE
400 N=1:GOTO 540
410 IF I$(1) <> "R" THEN 440
420 REM RESET TEAM FOUL ROUTINE
 438 M(0,0)=0:M(1,0)=0:PRINT@1000, "TEAM FOULS RESET";:GOTO 180
 449 IP I$(1) = "X"THEN 100
450 REM SEE IF USER WANTS HELP
460 IF IS(1)="?" THEN GOSUB 1270 :GOTO180
470 REM USER KEY / IN ERROR?
480 IF IS(1)="/" THEN GOSUB1270 :GOTO180
498 REM USER WANT TO EXIT PROGRAM
500 IP IS(1)="E" THEN END
510 REM CODE NOT VALID - GIVE USER ANOTHER TRY
 520 GOTO 180
530 REM BEGIN SECOND CHARACTER VALIDATION
540 IF I$(2)="A" THEN 630
              ADD TEAM/PLAYER ROUTINE R OR V SET UPON ENTRY
550 REM
560 REM EXTRACT VALUE FOR NO OF PLAYERS
570 Q=J(N,0)
500 FOR P=1 TO Q
590
        IP 1$(0) = A$(N,P) THEN 010
600 NEXT
618 REM PLAYER NOT IN LIST
628 PRINT@1888, "PLAYER NOT FOUND";:GOTO 188
638 CLS: Q=J(N,8)
648 IF O<>8 THEN 688
650 REM NO PLAYERS YET - REQUEST TEAM NAME
650 HEN NO PLAIERS ILL ALGOS (N.0)
660 INPUT "ENTER TEAM NAME"; B$(N.0)
670 K=LEN(B$(N.0)): IF K>12 THEN PRINT "TEAM NAME I2 CHARS OR LES
5 - REENTER": K=0: GOTO 660
688 Q=Q+1
698 IF Q<14 THEN 728
700 PRINT@1000, "TOO HAMY PLAYERS"; : INPUT C$: GOTO 1050
710 REM ADD PLAYER ROUTINE
720 INPUT "ENTER PLAYER'S NUMBER AS TWO DIGITS (05,13)"; A$(N,Q)
730 K=LEN(A$(N,Q)): IF K<>2 THEN PRINT "ND MUST BE 2 DIGITS - REE
NTER": K=0: GOTO 720
740 INPUT "ENTER PLAYER'S NAME (12 CHAR LIMIT)"; B$(N,Q)
750 K=LEN(B$(N,Q)): IF K>12 THEN PRINT "PLAYER'S NAME NUST BE 12
CHARS OR LESS - REENTER": K=0:GDTO 740
760 INPUT "MORE PLAYER'S TO ADD7 REY: Y/N"; Z$
770 IP 25="N" THEN 000
700 Q=Q+1:PRINT:GOTO 720
790 REM SAVE NO OF PLAYERS AND EXIT
889 J(N,8)=Q:GOTO 1858
818 IF 1$(2)<>*8" THEN 858
020 REM BASKET SCORED ROUTINE
030 J(N,P) = J(N,P) + 1
                                                                                       Program continues
```



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1420 RETURN

1440 INPUT C\$:RETURN

1430 PRINT@998, "PUSH 'ENTER' TO CONTINUE"

```
Program continued
 040 L(N,F)=L(N,P)+2:L(N,0)=L(N,0)+2:GOTO 1050 850 IF IS(2) <>"L" THEN 890
 860 REM 3 POINT BASKET SCORED ROUTINE
 870 J(N,P) = J(N,P) + 1
 880 L(N,P)=L(N,P)+3:L(N,0)=L(N,0)+3:GOTO 1050
890 IF 1S(2)<>TT THEN 930
 900 REM TWO FOULS MADE ROUTINE
 910 K(N,P) = K(N,P) + 2
 920 L(N,P)=L(N,P)+2:L(N,0)=L(N,0)+2:GOTO 1050 930 IF IS(2)<>"F" THEN 970
 940 REM ONE FOUL SCORED ROUTINE
 950 K(N,P) = K(N,P) + 1
 960 L(N,P)=L(N,P)+1:L(N,0)=L(N,0)+1:GOTO 1050
970 IF I$(2)<>"P" THEN 1030
 980 REM PERSONAL EOUL ROUTINE
 990 IF M(N,P) < 6 THEN M(N,P) = M(N,P) + 1
 1000 IF M(N,0) < 7 THEN M(N,0) = M(N,0) + 1
 1010 GOTO 1050
 1020 REM
             SECOND CHARACTER INVALID - TELL USER
 1030 PRINT@1000, "SECOND CHARACTER INVALID"; : GOTO 180
 1040 REM SCREEN DISPLAY ROUTINE
 1050 CLS:N=0:P=1:I=J(0,0):IF J(1,0)>I THEN I=J(1,0)
1060 PRINT TAB(0)"H:";TAB(3)B$(N,0);" ->";L(M,0);TAB(24)"TF-";M(N,0);TAB(33)"V:";TAB(36)B$(P,0);" ->";L(P,0);TAB(57)"TF-";M(P,0)
 1070 PRINT TAB(1) ** PLAYER"; TAB(17) "G F PT PF"; TAB(34) ** PLA
 YER": TAB(50) "G F
1000 FOR Q = 1 TO 13
                           PT
 1090 IF I(Q THEN PRINT: GOTO 1110
  1105 \  \, PRINT \  \, TAB(\emptyset)\,A\$(N,Q)\,; TAB(3)\,B\$(N,Q)\,; TAB(16)\,J(N,Q)\,; STR\$(K(N,Q))\,; TAB(23)\,STR\$(L(N,Q))\,; TAB(27)\,STR\$(M(N,Q))\,; TAB(33)\,A\$(P,Q)\,; TAB(36) 
 B$(P,Q);TAB(49)J(P,Q);STR$(K(P,Q));TAB(56)STR$(L(P,Q));TAB(60)ST
 RS(M(P,Q))
 1110 NEXT
 1120 GOTO 180
 1130 REM INFORMATION SCREEN DISPLAY ROUTINE
1140 CLS: PRINT TAB(16) "BASKETBALL SCOREKEEPING PROGRAM"
 1150 PRINT: PRINT "PROGRAM WAS DESIGNED FOR EASE OF USE WHILE KEEP
 ING SCORE OF A"
 1160 PRINT"BASKETBALL GAME IN PROGRESS AT ANY COMPETITIVE LEVEL
  - PRO."
  1170 PRINT"COLLEGE, SCHOLASTIC OR PICK-UP VARIETY.": PRINT
  1180 PRINT PROGRAM FEATURES A 'HELP' FACILITY BY KEYING '?' AND
 CODES FOR: "
 1190 PRINT"2 POINT FIELD GOALS, 3 POINT FIELD GOALS (PROS), 1 OR
     FOUL'
 1200 PRINT"SHOTS MADE, AND RECORDING A PLAYER'S PERSONAL FOULS."
  : PRINT
 1210 PRINT"LIMITATIONS INCLUDE: 12 CHARACTER MAXIMUM FOR NAMES O
  F TEAMS"
 1220 PRINT"AND PLAYERS, TEAMS CAN HAVE A MAXIMUM OF 13 PLAYERS."
 1230 PRINT: PRINT
 1240 PRINT TAB(39) "PUSH 'ENTER' TO CONTINUE"
1250 INPUT C$
  1260 RETURN
  1270 REM VALID INPUT CODE SCREEN DISPLAY ROUTINE
  1280 CLS: PRINT@9, "VALID INPUT CODES FOR THE 'ENTER DATA' REQUEST
  1290 PRINT@133, "CODES: ?":PRINT@145, "HELP NEEDED, DISPLAY THIS
  SCREEN"
  1300 PRINT@205, "D": PRINT@209, "DISPLAY TEAM AND PLAYER INFORMATIO
 1310 PRINT@269, "R": PRINT@273, "RESET TEAM FOULS TO ZERO"
1320 PRINT@333, "X": PRINT@337, "INPUT KEYING ERROR - IGNORE (IN A
  NY POSITION)
 1330 PRINTE397, "E":PRINTE401, "GAME OVER - EXIT FROM PROGRAM"
1340 PRINTE460, "HA":PRINTE465, "ADD PLAYER TO HOME TEAM LIST"
1350 PRINTE524, "VA":PRINTE529, "ADD PLAYER TO VISITING TEAM LIST"
  1360 PRINT@500," ( * = 'H' FOR HOME TEAM, 'V' FOR VISITING TEAM B
  ELOW) "
  1370 PRINT@650, "*BNN": PRINT@657, "2 PT FIELD GOAL BY PLAYER NN"
1380 PRINT@714, "*LNN": PRINT@721, "3 PT FIELD GOAL BY PLAYER NN (P
  1300 PRINT0714,"
ROS/LONG SHOT)"
  1390 PRINT@778, "*FNN": PRINT@785, "1 PT FOUL SHOT MADE BY PLAYER N
  1400 PRINT@842, "*TNN": PRINT@849, "2 PTS ON FOUL SHOTS MADE BY PLA
  YER NN'
  1410 PRINT@906, "*PNN": PRINT@913, "PERSONAL FOUL AGAINST PLAYER NN
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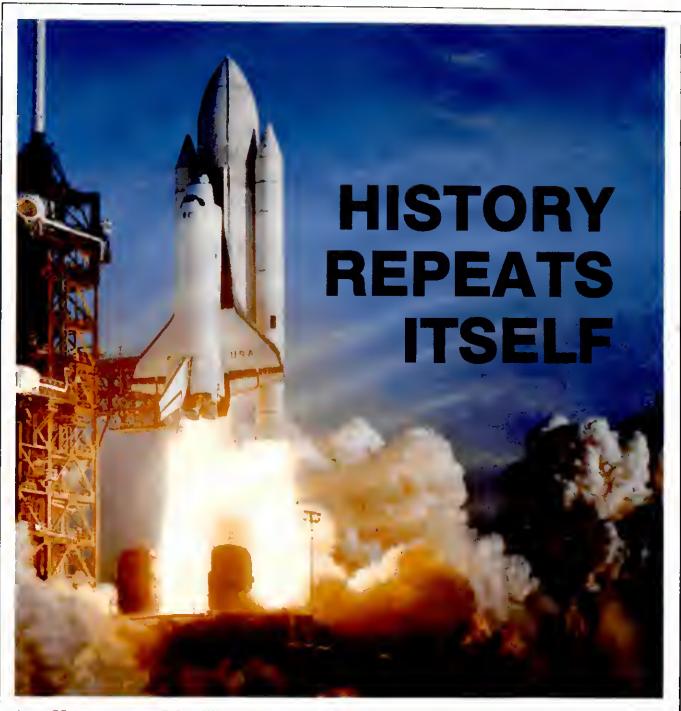
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"To help us recognize the 'programs' or levels of thought in our own minds, Hofstader engages us in various mind games."

ple. There is no psychological proof to chart the metamorphosis of neuron action to symbol recognition to iteration. To help us recognize the "programs" or levels of thought in our own minds, Hofstader engages us in various mind games. This is the purpose of the fictional dialogs that follow each chapter of Godel, Escher, Bach.

The mein characters of the dialogs are the Tortoise and Achilles. The choice of these figures was inspired by Zeno and by Lewis Carroll. Zeno, a Greek mathematician, wrote a tale about a foot race between the Tortoise and Achilles to Illustrate his theories of paradoxes of motion. Lewis Carroll, the author of Alice in Wonderland and a Nineteenth-century mathematician, borrowed the Tortoise and Achilles from Zeno to write a dialog about reasoning Carroll's dialog is reprinted in Godel, Escher, Bach. Each dialog in the book helps us conceptualize the intricate methods of human thought.

Hofstader's dialog titled "Crab Canon" tells the story of a chance meeting between Achilles and the Tortoise in the perk. In the middle of their conversation, they are interrupted by a friend, the Crab. The title, "Crab Canon," has more significance in relation to the dialog.

"Crab Canon", you'll recall, is a theme followed by Itself in reverse. The notes read the same melody backwards and forwards. In Hofsteder's "Crab Canon" the lines are virtually the same when they are read from the end or from the beginning. For instance, the opening lines of the dialog are:

Tortoiss: Good day, Mr. A.
Achilles: Why, same to you
Tortoise: So nice to run into you.
Achilles: That schoes my thoughts.
Tortoise: And it's a perfect day for a walk. I think I'll
be walking home soon.

And the closing lines:

Achilles: And it's a perfect day for a walk. I think I'il be walking home soon.

Tortoise: That echoes my thoughts.

Achilles: So nice to run into you.

Tortoise: Why, same to you.

Achilles: Oood day, Mr. T.

When the Crab appears, he's full of multiple-entendres end self-reterences. He talks about himself, saying he "would crab up a storm." Of course, his name, the Crab, is self-reference within the dialog. But the Crab's words also hint at the structure of

the dislogue. "Which came first—the Crab, or the Gene?' That is to say, 'Which came last—the Gene, or the Crab?" (His reterence to his genes reflects on the structure of meaning in yet another way. Unless you're familiar with the genetics of crabs, you'll have to read Godel, Escher, Bach to appreciate the allusion.)

The conversation between the Tortoise and Achilles touches on a print by Escher in which interlocking crebs are formed by the figure end the ground, and also on a crab canon in Bech's *Musical Offering*. In less than four pages, the word "crab" has acquired a myriad of symbolic maenings.

The "Crab Canon" is a highly structured place of writing that causes numerous sets of operations to be carried out within the reader's cognitive system. But we use such deep and intertwined levels of interpretation daily. While I was reading Godel, Escher, Bach, I dreamed one night that I was an AI researcher. My dream is a less sophisticated story than Hofstader's "Crab Canon." But it is a clear exemple of several levels of implicit meaning within the hierarchy of my own thought processes.

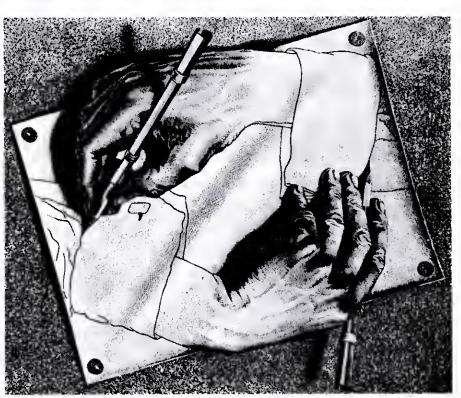
An Airesearch project I had been working

on for many years was reaching its culmination. Yet, I felt the answers to many of my questions were beyond my reach, I had access to a vast computer system and to several microcomputers. None of them could help me form ideas, I left the lab to walk along a secluded beach at twilight.

I walked up and down the beach for several hours. I contemplated subtle distinctions between the minds of men and the minds of machines. Finally, I laid down beneath a cluster of palm trees to sieep. As I listened to the waves, I thought to myself, "At least in this way, the human being will always be different from computers." I had struggled with Ideas and depression, and I had been comforted by nature.

When I awoke at dawn one of my microcomputers was beside me. It presented me with an exhaustive catalog comparing and contrasting the most current facts about human and machine intelligence. I hadn't programmed the computer to generate the list. It had acted on its own volition.

In many ways, the dream is a synopsis of Godel, Escher, Bach. First, some thought petterns Hofstader stresses are evident. There's a circular pattern of self-reference,



M. C. Escher's Hand Drawing Hand
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"The debate over artificial intelligence is a two-step strange loop, an infinite quest represented by an interplay between questions and answers."

not unlike a Strange Loop. While I was asleep I dreamed; and in that dream, I dreemed I fell asteep.

Within the dream, I awoke at dawn. For me the image of awaking at dawn isthrough isomorphism—a symbol of human discovery. When I actually woke up the next morning, I'd geined insights to Godel, Escher, Bach.

The dream's synopsis of the book begins with its recognition that the distinctions between human and computer Intelligence ere apparent. Scientists end researchers have a relatively strong understanding of the thought processes of number computation, and to some extent of logic. These things we have programmed into computers with measured success.

The dream also recognizes that the gap between the two intelligences is currently the burden of human intelligence. To us volition and creativity are mysterious processes, and so far unprogrammable. The achlevements of programs such as SHRDLU help us understand our own intelligence. And as our understanding of our own intricate thought processes increases. It seems inevitable that computer intelligence will advance. At the conclusion of the dream, the question "Can machines think?" is overshadowed by a new question. "Can machines feel emotion?"

Alan Turing, the computer scientist quoted at the opening of this article, believed the complexity of the operations and responses a mechine is programmed to handle is related to the quality of its intelligence. Hotstader gives a great deal of consideration to Turing's suggested test for computer intelligence, and also to the common objections to machine intelligence which Turing anticipated. But Hofstader also considers a response to Turing's proposals by the philosopher J.R. Lucas. The following remarks are from Lucas' paper Minds, Machines, and Godel. A lengthy excerpt is included in Godel, Escher, Bach.

"Complexity often does introduce qualitative differ ences. Although it sounds implausible, it might turn out that above a certain level of complexity, a machine ceased to be predictable, even in principle, and started doing things on its own eccount, or, to use a very revealing phrase, it might begin to have a mind of its own. It would begin to have a mind of its own when it was no longer entirely predictable and entirely docile, but was capable of doing things which we recognized as intelligent, and not just mistakes or random shots, but which we had not programmed into it. But then it would cease to be a machine, within the meaning of the act. What is at stake in the mechanist debate is not how minds are. or might be, brought into being, but how they operate."

Here is a new question, closely related to the question presented by the dream. If we learn how minds operate, and if a machine is programmed to act like a human mind, and If that machine acts of its own volition, is it still a machine?

A friend of Hofstader's once commented that Ai should have its own incompleteness theorem because "Once some mental function is programmed, people soon cease to consider it an essential ingredient of 'real thinking." The paradox of artificial intelligence is that it exists (at some levels), but that existence cannot be proven. We know too little about human intelligence to bear the burden of proof.

The debate over artificial intelligence is a two-step strange loop, an infinite quest represented by an interplay between questions and answers. When one question is answered, another will always arise. This is the central message of Godel, Escher, Bech: An Eternal Golden Braid.

Nancy Robertson is the former news editor for 80 Microcomputing. She is now living and writing in Peterborough,

M. C. Escher photographs courtesy of the Vorpal Galleries.



M. C. Escher's Waterfall

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Correcting a failure to communicate.

Tape Regenerator

Cass R. Lewart 12 Georjean Dr. Holmdel, NJ 07733

The tape recorder is an inexpensive and popular means of program and data storage for the TRS-80. Even disk owners still need the tape recorder to transfer purchesed cassette programs to disk. Unfortunately the tape recorder brings its share of problems to the unwary. One of the most frustrating moments for a TRS-80 owner is when, after spending several minutes loeding a new program, the letter "C" or a permenent double asterisk appears in the right upper corner of the monitor screen.

Frequently a Basic tepe may seem to load correctly, but will produce a garbage listing.

Regardless of the symptoms, the diagnosis is the same—an irrecoverable error occurred during program reading.

(At this point, grown men and women have been known to cry.) The only way to load a program from a poorly recorded tape is to find by repeated trial and error the very narrow range of volume control settings good for this particular tape. There is also no assurance that the volume control setting will work the next time around even with the same tape; a slight recorder head misadjustment may require repeating the whole procedure.

The Problems

The reason for difficulties in loading commercial tapes such as Radio Shack's is that they are reproduced on high-speed audio machines not specifically designed for digital encoding and not always kept in tip-top condition. The ideal signal wave form and the typical good and poor wave forms found on commercial copies of Level II programs are shown in Figs. 1 and 2. The superimposed noise, 60 Hz hum,

amplitude distortion, ringing, and, what is worst—the incorrect displacement of the data pulses relative to the clock pulses—make it difficult or even impossible for the computer to read the tape.

If a single reading error occurs, e.g., one out of 100,000 pulses in a typical program is misread, then the whole program cannot be executed. Once a Basic program has been properly loaded one can make a good backup copy of it with the CSAVE command. It is not as straightforward with System programs. Monitors such as T-Bug, MON3, RSM or TRCopy will generate a backup copy of a System program, but with severe limitations, i.e., the original program has to be readable and the program cannot overwrite the monitor.

The Solution

The Tape Regenerator, on the other hand, will take any TRS-80 tape with Level II Basic or System programs, even if it is poorly recorded, and generate, using the TRS-80 computer, a backup copy of the programs on a second tape recorder. The Tape Regenerator circuit and the associated program Regen reshape and retime the pulses on the new tape, thus producing a tape that is easily read by the TRS-80 circuitry.

The Tape Regenerator does not care whether a program consists of multiple segments with separate loader or whether there is more than one program on a tape. Regen operates on one pair of clock/data pulses at a time, and unlike the monitor programs it does not store the whole program in computer memory. Thus tapes with multiple programs can be handled in a single run and even a 4K computer can back up copies of large programs.

it should be mentioned that several commercially available hardware devices (Data Dubbers) were designed for the same purpose as the Tape Regenerator.

```
Audio transformer, R. Shack 273-1380 or equiv
                   12 Voli fransformer, R. Shack 273-1385 or equiv
T2
                   Sillicon diodes 50 Volt/1A
01 D2
                   3-6 Volt Zener diode
                   Bridge rectifier 50 Volt/1A
RECT
LEO1,LED2,LEO3 Red light emitting diodes
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C2.C3
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$1,52
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A drilled glass epoxy silk screened printed circuit board, and a listing of Regen in Basic to aflow POKEing it into
```

memory can be purchased from C&R Electronics, P.O. Box 217, Holmdel, NJ 07733 for \$10.95 ppd. New Jersey

Table 1, Parts List

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"The backup tapes produced from these devices...retain and may even worsen the timing jitter..."

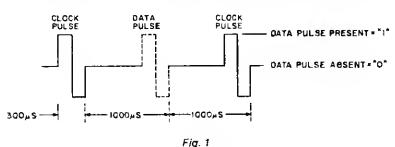
However, these devices only reshape the clock and data pulses and do not retime them in respect to each other as Regen does. The beckup tapes produced by these devices, though better in some respects than the originals (thanks to pulse reshaping) retain and may even worsen the timing jitter—one of the major causes of tape reeding difficulties.

To test the soundness of the regeneration epproach, multiple generations of the same progrem were made by generating tepe 2 from 1, tape 3 from 2, etc. The test was run through five tepe generations with a tairly long System program. It was found that a fifth generation tepe would load on the computer as easily as the first generation tape with no apparent degradation in quality. Backup copies were elso made of commercial tapes that, due to poor recording, would not load properly at dozens of different volume control settings. The backup copies loaded then with no difficulties.

Circuit Description

The circuit shown in Fig. 3 reshapes the clock and data pulses received from the first tape recorder and feeds them to the computer for processing. The audio transformer T1 provides DC separation between the tape recorder and the rest of the circuit. Switch S1 and diodes D1 and D2 allow selection of the better half of the pulse (see Control Adjustments). Zener diode D3 and transistor Q1 further shape the incoming signals.

The NOR gate in iC1 decodes the iN commend from the computer indicating that it is ready to accept data for further processing. Spare gates in the IC1 serve as buffers and open the gate in IC2 to let the clock/date pulses pess via P1 connector to the data bus in the computer. LED1, LED3 and LED2 indicate respectively that the circuit is powered, that the Regen program is running and that the tape recorder is sending data et the proper level.



rig. i



TYPICAL WAVE FORMS FROM TAPE RECORDER

b. POOR RECORDINGS

CLOCK



CLOCK





Fig. 2



BIG CP/M* programs on TRS-80* MODELS 1 & 3

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"The signal is partially reshaped... still it frequently can be read... where the original tape could not."

Transformer T2 in conjunction with the voltage regulator IC3, full wave rectifier RECT and two capacitors provides 5V to power the transistor and IC3. J2 provides a "quick and dirty" direct output to the TRS-80 if no beckup copies are required. The signal at this point is partially reshaped but not retimed. Still it frequently can be read by the computer where the original tape could not be read.

Regenerator Program Regen

The Regen program shown in Listing 1 takes care of retiming and resheping of Level II clock and data pulses. After clearing the screen, displaying a message with the author's name, and putting a graphic character in the upper right corner of the screen, the program walts for the clock pulse from the first tape recorder. After finding it another test is made to make sure that it was not a transient.

When the clock pulse is confirmed, it is put out after a 200-microsecond delay using subroutine output. This subroutine produces a perfect signal, as shown in Fig. 4, via the computer plug leading to the recording (AUX) jack on the second tape recorder. The graphic screen character is changed every time a clock pulse is detected to indicate that something is

happening. A search for the data pulse now begins. A delay of 500 microseconds excludes any residual ringing from the preceding clock pulse.

If no data pulse is found during the following 700-microsecond window, the search for the next clock pulse starts again. If a data pulse is found, it is tested to exclude a transient; if the data pulse is confirmed, it is put out at the end of the 1000-microsecond interval that started at the beginning of the preceding clock pulse as shown in Fig. 4. A data pulse appearing any time between 500 microseconds and 1200 microseconds after a clock pulse is thus correctly retimed to occur exactly 1000 microseconds after the clock pulse.

The program then continues after a 100-microsecond delay with the search for the next clock pulse. The above-mentioned delay constants of course could be modified to operate on Level I programs, or to make Level II programs generated on the Model I computer more readable on the Model III computer, with its slightly different optimum tape-timing requirements.

Regen can be loaded either from Listing 1 using EDTASM or one of the monitor programs, or it can be loaded by running an equivalent Basic program mentioned in the parts list, which will POKE the program into memory.

Operating Instructions

- 1. Turn off the power, then make all connections between the tape recorders, computer, and the Tape Regenerator as shown in Fig. 5.
- 2. Turn the power on to the computer and the Tepe Regenerator. LED1 should light up and the Memory Size question should appear on the screen. If it does not, check all connections, in particular the 40-pin connector from the Tape Regenerator to the CPU or the expansion interface. Repeat steps 1 and 2 if necessary.
- 3. Load the Regen progrem and run it. LED3 should now light up, author's name should appear in the middle of the screen, and a stationary graphic character should appear in the right upper corner. The program is in an infinite loop and will run until you reset the computer or turn it off.
- 4. Stert playing the tepe from tape recorder 1 and set the polarity switch and the volume confrol on the tape recorder as explained under Control Adjustments. Rewind the first tape recorder.
- 5. Stert tape recorder 1 in play mode and tepe recorder 2 in record mode. Observe LED2 and the changing grephic character on the screen. When LED2 goes dark and the graphic character stops changing, you are finished with the recording. Turn off

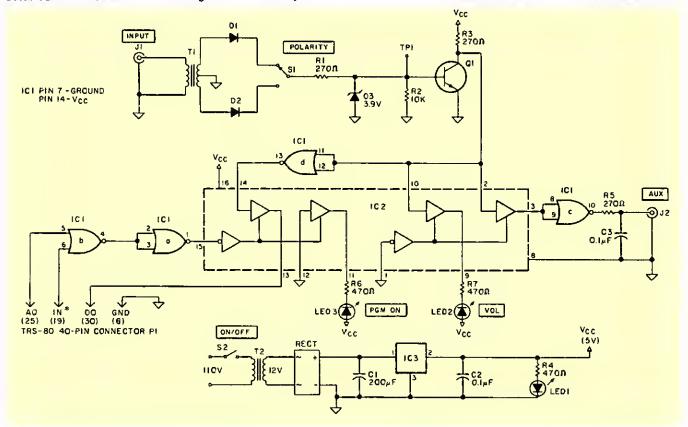


Fig. 3

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ACHTARDEMON TO PARAMETER **

"The Tape Regenerator will only process tapes having complete program information."

everything. The 40-pln connector can be left in placa as it does not interfera with normal computer operation.

Control Adjustments

Thare are two controls to be set to properly read a poorly racorded tape: the polerity switch in the regenerator circuit and the volume control on the tape recorder. Make both settings while the tape recorder t is in play mode. The settings will vary from tape to tape depending on the machine on which it was recorded. However, your own backup tapes produced with the Tape Regenerator or CSAVE command should all work with the same settings. First, set the polarity switch to the position giving a stronger signal as evidenced by LED2 being brighter at a low volume control setting. Then find the opti-

volume control setting by one of the following methods:

- Turn up the volume control until LED2 lights up brightly, than back up slightly.
- Turn the volume control elightly above the point when the graphic character in the corner of the screen starts changing.
- Obsarva the incoming pulses with a scope at point TP1 (best mathod) and adjust the volume control for cleanest and widest pulse shape.

Program Limitations

The Tape Generator will only process tapes having complete program information. Tapes with eighteen-minute gaps (see history books) or those with pulses of very unsteady amplitude or embedded in noise are not acceptable. Neither the Tape Regenerator nor any other device will restore

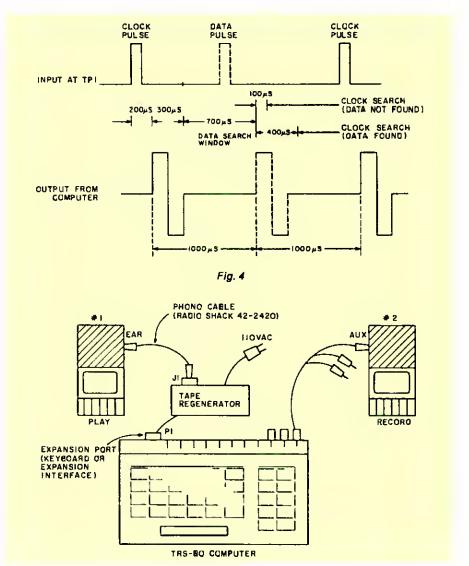


Fig. 5

"Neither the Tape Regenerator nor any other device will restore them."

them. The hardware and software described here will only work with a Model I, Level II computer.

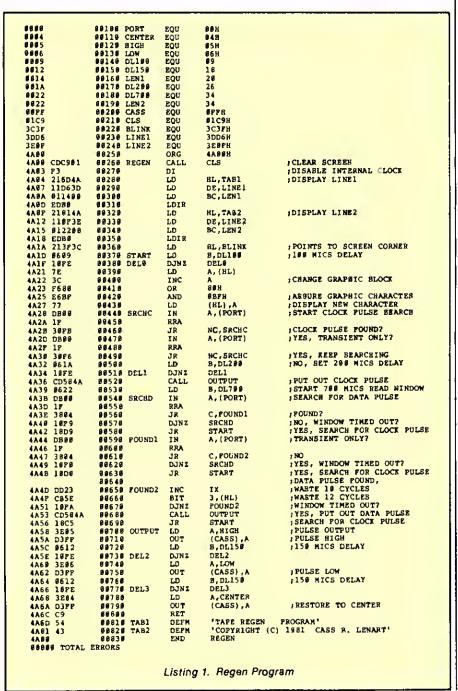
Proper cere mey prevent unexpected fireworks.

Construction Hints

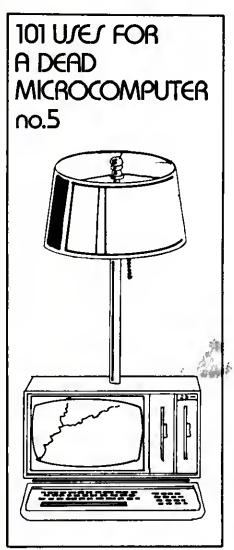
Keep all wires as short as possible; use of a printed circuit board is highly recommended. As only four contects are being used on the 40-pin connector you can spread the remaining contacts with a screwdriver for easy insertion. Before turning the power on, check ell connections.

Note for Disk Users

The Regen program is fully relocatable and cen be stored at eny convenient locetion in memory not interfering with DOS. The DI instruction et the beginning of the program will assure that the internel clock, which would interfere with tepe operation, is not running.



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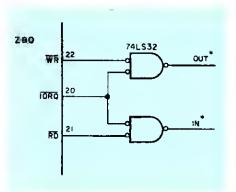


Fig. 1. I/O Control = Bus Signels In the TRS-80.

A←(n)

Data byte at Port (n) is transferred to accumulator.

Formet:

Opcode Operands

IN A,(n)

1,10,1,10,1,1 OBH

e—n—→

Description:

The operand n is placed on the bottom half (A0 through A7) of the address bus to select the I/O device at one of 258 possible ports. The contents of the Accumulator also appear on the top half (A8 through A15) of the address bus at this time. Then one byte from the selected port is placed on the data bus and written into the Accumulator (register A) in the CPU.I

M CYCLES: 3 T STATES: 11(4,3,4) 4 MHZ E.T.: 2.75

Condition Gits Affected: None

Example

If the contents of the Accumulator are 23H and the byte 78H is evallable at the peripheral device mapped to I/O port eddress 01H, then after the execution of

IN A (01H)

the Accumulator will contain 76H.

Fig. 2. Out Control = Bus Instruction.

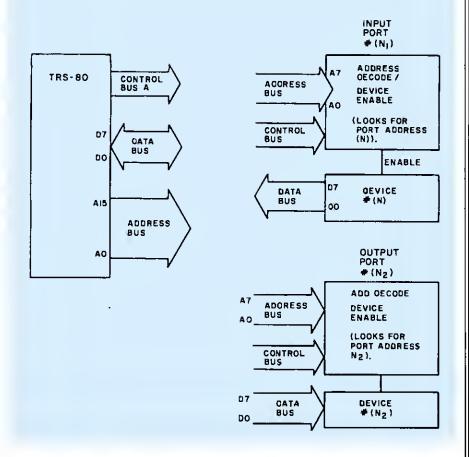
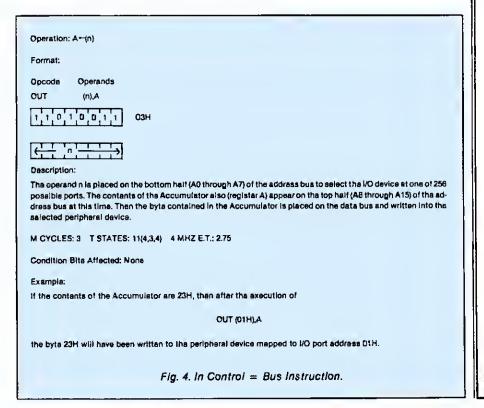


Fig. 3. Connection of data bus to data register of external device.



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"Apply power to the real world interface; all LED's should be lit."

bus into the outside world and convert information from that world into a tormat acceptable to the date bus. This information must arrive at the data bus at a precise time; otherwise it will be missed or conflict with other signals, resulting in chaos. Properly synchronized signals are generated by the central processing unit (CPU) for I/O control.

Fig. 1 shows how in and Out control-bus signals are generated. The Z-80 responds to "OUT (N), A" (Fig. 2), by outputting a logic 0 on pins 20 (IORQ*) and 22 (WR*). A logic 1 appears on pin 21 (RD*) as the Z-80 torbids RD* and WR* signals from being low simultaneously. The IORQ* and WR* signals are AND-ed in a 74LS32 and buffered by a 74LS367 providing the TRS-80 OUT* control-bus signal whenever those outputs are low, as indicated by the asterisks.

At the same time, the CPU outputs the second byte of the Instruction (a binary number between 00000000 end 11111111) onto the lower eight lines of the address bus causing connection of the data bus to the data register of the external device (see

Fig. 3)

The "OUT (N), A" Instruction also transfers data from the Z-80 accumulator to a latched data register in the external device.

The "IN A, (N)" command (Fig. 4) is similarly handled. Data flow is from the external device to the Z-80 accumulator, Register A. Input normally does not require latching hardware.

instead of the variety of integrated circuits required for signal control, output latching and input buffering, an 8255 Programmable Peripheral Interface is used. Depending on software, this 40-pin device has three eight-bit ports which may be used for input or output; a tri-state bi-directional bus transceiver; or a 12-bit output port with an eight-bit ≠ input port and a four-bit status port.

For our purposes the 8255 is programmed for simple I/O with ports A and B as latched output ports, and port C as an unlatched input port. Port B is uncommitted.

Some Introductory Experiments

Fig. 5. shows the real world interface cir-

cuitry required for these experiments. Integrated circuits U5, U6, U7 and transistors Q1 and Q2 are not used and need not be installed. A well-regulated (4.75–5.25 v. max.) +5-volt DC supply capable of delivering one ampere is required (see Fig. 6).

Before attempting these experiments remove the power from your TRS-80 and the power supply. Never leave power on while setting up test hardware.

Before installing the interconnect cable to the TRS-80 and the real world interface, connect the power supply to the real world interface's +5 and ground terminals. Turn on the power supply. Eight light-emitting diodes should light up. If not, disconnect the power supply and examine the board for soldering defects.

If all indications are normal, turn off the power supply, but do not disconnect it.

install the 40-pin card-edge end of the Interconnect cable to the TRS-80 expansion port with the ribbon cable exiting upward. Pin 1 of the 40-pin DIP plug goes to pin 1 of socket SQ 1.

Apply power to the real world interface;

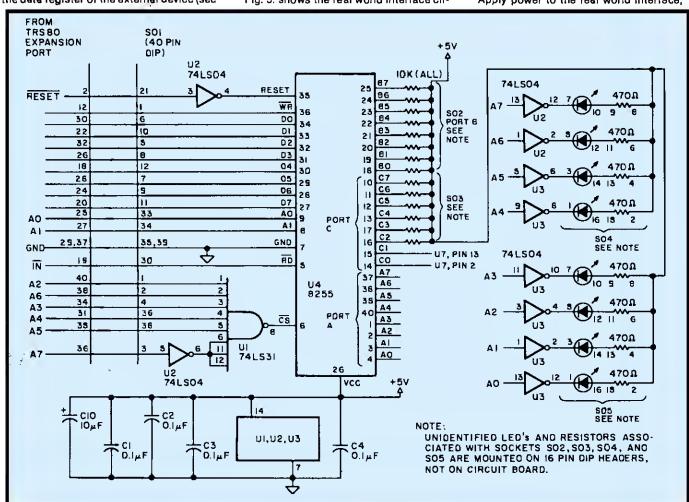


Fig. 5. Real-World Interface Circuitry.

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"You may return to Basic at any time without losing programs in memory."

all LED's should be lit.

Turn on the TRS-80 power. A normal memory size start-up routine should occur. No memory need be reserved for these experiments, so press Enter to get into Level II Basic.

Enter and run the following Basic program:

10 OUT 127, 137 ('Configures 8255) 20 OUT 124, 85 ('Loads 55H into Port A)

Every second LED should be lit. Change line 20 to:

20 OUT 124, 170 ('Loads AAH Into Port A)

Run it. You should observe the first, third, tifth and seventh LED lit. You may want to try other values in the second term of line 20.

Next enter and run the following Basic program:

10 OUT 127, 137

20 FOR N = 0 to 255

30 OUT 124, N:NEXT N

40 GOTO 20

The LEDs should continuously cycle from zero through 255. Because the count is rapid, the two least significant digits on the right appear to be on all the time.

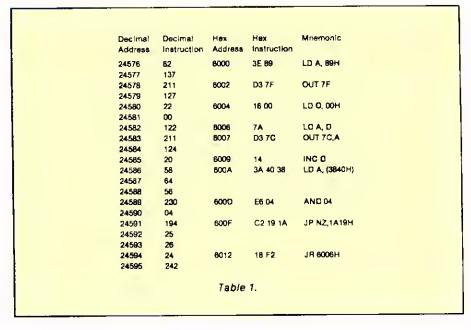
Insert the following line into the program and run it:

25 FOR M = 0 TO 100:NEXT M

Now the two least significant (right-hand) digits should clearly blink on end off and the count can be visually tollowed.

Next, enter the same program in machine code using either the Basic POKE command, or load the T-Bug, RSM or EDTASM System programs. Keying in the hex words with T-Bug or RSM is fastest and easiest (see Table 1).

Refer to your system's instructions in



loading this program. The first few instructions using the POKE command appear as follows:

10 POKE 24578,82:POKE 24577,137:POKE24578,211: POKE 24579,127 (etc.)

Execute the program at 6000H. In Basic this is done by entering the System command. When an asterisk appears on your screen, type /24576 and press Enter to commence execution at 6000H. All the LEDs should be on, although the more significant (left-hand) bits may appear slightly dimmer than the least significant bits. The microprocessor is counting near its maximum speed—eround 100,000 counts per second.

Next, delete the last line of the program and insert Table 2.

Execute the program beginning at 6000H. The instructions slow the count by a factor of approximately 300. The count now ap-

pears at about the same rate as the Basic program running at its festest speed.

To slow the machine code program down to where all the bits may be visually observed, delete the last three program instructions and insert Table 3.

These steps slow the microprocessor by a factor of around 100,000. You may want to try loading different values into register pair BC. Loading BC with 0000H decrements it 214 (65,536) counts before both B and C are zero again. Loading BC with 0001H causes the minimum delay.

You may return to Basic at any time without going through Reset and losing programs in memory by pressing and holding the Breek key until the Basic prompt appears. It may take a second to work through the delay routine and get to your breek signal. You may return to the machine code routine by exiting Basic with a System command, then answer the asterisk prompt as before

When In Basic, enter and run:



- 20 CLS:INPUT "ENTER A NUMBER BETWEEN 0 AND 255 INCLUSIVE";N
- 25 IF N<0 OR N>255 GOTO 20
- 30 OUT 124,N
- 35 S\$ = INKEY \$: REM WAIT FOR ANY KEY DOWN
- 40 GOTO 20

For each decimal number entered the LEDs should indicate the equivelent binary number.

Here's one for the Trekkles. Enter and run:

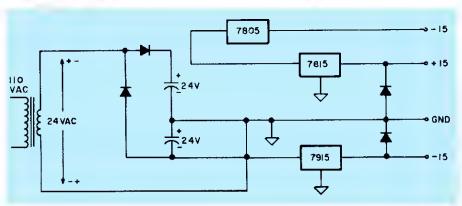


Fig. 6. Typical +5 volt, and ± 15 volt direct current supply.

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OUT 127, 137
CLS: PRINT@320 "PRESS 'L' TO GO LEFT. PRESS 'R' TO GO RIGHT
A\$ = INKEY\$:IF A\$ = "L" GOTO 30
IF A\$ = "R" GOTO 80
GOTO 10
A = 1
OUT 124, A
FOR X = 1 TO 10:NEXT X
C\$ = INKEY\$:IF C\$ = "R" GOTO 80
A = 2*A: IF A>129 GOTO 30
GOTO 40
A = 128
OUT 124, A
FOR X = 1 TO 10:NEXT X
C\$ = INKEY\$:!F C\$ = "L" GOTO 30
A = A/2
IF A<1 GOTO 60
GOTO 90

Press L to go left. Press R to go right. Neat. This is still just a fancy version of turning a switch on and off.

Now that digital information is released from the confines of the personal computer, it remains to be converted into a form meaningful to the physical world.

Next month we will explore the applications of digital-to-analog conversion as a means of sophisticated control. ■

24594	GO .	6012	68 00	LD 8, 0	
24595	00				
24596	18	6014	10 FE	DJNZ FE	
24597	254				
24598	24	6016	18 EE	JR 6006	
24599	238				
-		Table :	2.		
	24595 24596 24597 24598 24599	24595 00 24596 18 24597 254 24598 24 24599 238	24595 00 24596 18 6014 24597 254 24598 24 6016 24599 238	24595 00 24596 18 6014 10 FE 24597 254 24598 24 6016 18 EE 24599 238	24595 00 24596 18 6014 10 FE DJNZ FE 24597 254 24598 24 6016 18 EE JR 6006 24599 238

24594	01	6012	01 00 00	LO BC, 00 00H	
24595	00				
24596	00	6015	08	DEC BC	
24597	11				
24598	121	6016	79	LOA, C	
24599	176	6017	B0	OR 8	
24600	32	6018	20 FB	JR FB	
24601	251				
24602	24	601A	18 EA	JR 6006	
24603	234				
		Table 3	3.		



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Profile

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Bill O'Brien 11 Dongan Place New York, NY 10040

Profile is probably the greatest program Radio Shack has released, far surpassing the potential of Microfiles, although it costs \$20 less.

What makes it so great? The higher priced Microfiles leck useability; the user can access data stored in Profile, using it to provide information for programs which can be manipulated and output outside the Profile environment.

Profile is a data storage/retrieval system available for the TRS-80 Model I. It consists of four sub-programs—init, Access, Print and Profile—and uses Disk Basic with one drive, with additional drives and a line printer optional.

The User's Manual begins with a general description of the terms used throughout the instructions, and the reminder that you cannot use the lowercase driver to enter date. Standard computer format is date entry with uppercase characters only. Lowercase is great for word processing, but it's not that great a loss. (For those of you keeping score, Microfiles has the same restriction.)

Profile is a machine language program that loads through DOS and asks the user, "How Many Drives (1-4)?" Be sure you have the program disk in drive 0, there are calls to other routines stored on that disk. Also, a tormatted disk should be in any other drives.

In a few seconds your screen will be

ablaze with life as the Profile program takes control. You will see a program header at the top of your screen, what appears to be operating instructions at the bottom of the screen (they are non-functional at this point in the program), and below that, the important message: Set Up Your Form—Press <Break> When Done.

Creating the Field

First, using the arrow keys to move the cursor, retitle the file by overwriting the program title line: **PROFILE DATA FORM** can be changed to: **MY DATA FILE**, or any other heading you want to give it. Then create the fields you want to store data in:

ACCOUNT NAME:

INVOICE#:

DATE: ././.

AMOUNT:

PO/JOB#:

POSTEO/PAIO: ././.

CHECKEO#:

Field headings can be whatever you choose, and are created by typing each literal (the field names are literals, while the values we will insert are variables), a colon and a space (which Profile recognizes as a delimiter), and whatever characters you decide to use to mark the size of the fields. (Periods are acceptable, but, as in the example, other characters are permissabledollar signs, for instance, to mark monetary fields.) Keep in mind that the top line of the screen is used solely for the file title, and the total space evailable for field information is 255 characters. If you exceed this limitation (after entering all those dots and slashes) a Data Too Long message appears and you must reformat the file content.

If you find that you've made a mistake anywhere, use the arrow keys to position the cursor over the error, or use <shift> D to delete a cheracter, or <shift> I to insert a

space (to add a character or align the field names for a professional look). Make sure that once you finish, the field names and lengths are exactly the way you want them. When you press the Break key you're stuck with it, and making changes later is a lot of trouble.

Sorting

After entering data you can sort it by any of the fields you established. When the program looks at an entry, it sees it exactly as it has been typed. If we sort by a numeric field in ascending order (included in Profile Is a search routine where the same rules apply), and two of the entries are \$1104.20 and \$9.68, something strange will happen.

Any common fool can tell that \$1100 is more than \$9, but the computer is no common fool; it's a very special kind of half-wit that takes everything literally. Therefore, as the computer sees it, nine is greater than one, so one comes first. Any numeric entry should have all spaces filled with zeroes. If our field is seven characters long, then 0023.89, 1404.13, and 0002.66 will produce the correct sort and search responses.

Searching for a particular entry or group of entries is accomplished by stating the field heading, and then specifying what qualities the found entries should have in relation to a comparator, which you enter using FORTRAN-like specifiers (NE, EQ, GT, LT, LE or GE for not equal, equal, greater than, less than, less than or equal to, and greater than or equal to.) For example, if you have an invoice number you want to search for, use INVOICE# as the field, EO as the comparator and the number in response to the Search For question, if you want a range over or above the number specified, use GT and LT, or GE and LE If you want the entered number included.

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Wayne Green, the publisher of Desktop Computing (and also of Kilobaud Microcomputing and 80 Microcomputing-both successful computing publications) has gone through both the agony and joys of working with computers. He has lost a quarter of a million on a mainframe big boy computer only to come out on the other side with all the frustration necessary to run a 200 employee publishing firm on several TRS-80'a.

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™TRS80 color

from the January 1981 issue of the CSRA Computer

There was some amusement at the November meeting when the Fladio Shack representatives stated that the software in the FOM carrindges could not be copied. This month's 68 Micro Journal reported they had disassembied the programs on ROM by covering some of the connector prins with tape. They promise details next month. Never tell a hobbyist something can'l be done! This magazine seems to be the only source so far of technical informations on the TRS-80 color computer. **Devoted to SS-50 6800 and 6809 mechanism up to now, 68 Micro Journal.** 6809 machines up to now, 68 Micro Journal plans to include the TRS-80 6809 unit in future issues.

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FLOPPY DISK DRIVES "... the computer is no common fool; it's a very special kind of half-wit that takes everything literally."

During the display/edit mode you can get hard copy of the entry displayed.

If it is your first run through the printing section, you will be asked to construct a print format. This consists of three lines of data: the title line, the column headings and the data line(s). One hundred and thirty-two columns of print are available; the screen scrolls sideways as you pass the 64-column mark that would normally terminate a video line. Again, the choice of literals is up to you, although title headings should have something to do with the field headings you entered. The field headings themselves may be used as column titles.

When you're done, tell the computer which fields are to be placed in what spaces. You then specify which field you went, its relationship to the comparator you've selected, and the program begins to print.

Fooling Profile

36 س

The one thing Microfiles has over Profile is that it will work with a serial printer whose driver you have loaded into memory while Profile won't. Whoever created the program included a routine to check if there was a printer attached to the parallel port (there's a memory location in the machine that gets loaded with a certain value; if that value isn't there, Printer Not Ready is written on

Remember I said it was a machine language program; and you're as big a klutz with machine language as I am, right? Don't fear, pilgrim, there is something you can do (no, not call Texas). Have you got a copy of NEWDOS or T-BUG around? (Aw, c'mon, everybody's got a copy of T-BUG.)

The offending portion of the code in the Print program looks like this:

7C84 3AE837 LD A.(37E8H) 7C87 FE80 СР 7C89 381D JR C,7CA8H

7C96 21003E	LD	HL,3E00H
7C8E 222040	LD	(4020H),HL
7C91 214875	LD	HL,7548H
7C94 CD2752	CALL	5227H
7C97 CD4552	CALL	5245H
7C9A CDCE76	CALL	76CEH
7C9D FE01	CP	01H
7C9F CA2152	JP	Z,5221H
7CA2 FEOD	CP	ODH:
7CA4 28DE	JR	Z,7C84H
7CA6 18EF	JR	7C97H

Bear with me, its not that complicated. I did it right, and as far as I'm concerned, Bill Barden might as well be reciting The Epic of Gilgemesh in the original Sumerian.

The NEWDOS Flx

If you have NEWDOS, run Superzap. With a backup copy of Profile in the drive, select the DD option, the disk drive number, track C. sector 9 (that's the position it was in on my copy). Look for the sector display that matches Fig. 1. Type MOD C1. (This is the position in the sector of the first disk location we will modify.) The screen will blink, an M will appear at the beginning of the line and you can now proceed to modify it. To do this, type "0" 72 times, covering the values 3A through EF. Press Enter and Y, making the modification permanent. This changes the instructions in the listing above to NOP, which is the same in machine language as a line number, and a colon followed by a blank line in Basic. The computer knows the lines are there, but skips over them, since there is No OPeration to be performed.

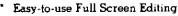
We just changed the code that told the computer what it is supposed to do. Originally it was supposed to load a value into the A register from memory location 37E8(hex) (LD is a machine code load instruction), compare it (CP is machine language for compare) to the hex value 80H (128 decimal), and if it found them to be the same, proceed to memory location 7CA8(hex) (JR C,7CA8H is a jump instruc-

180900	7221	Be71	9684	7EFE	2020	1A26	1001	8200	.1
100919	76F8	2100	3E22	2848	2107	75CD	3952	8682	1.>".@19R
180928	CD3C	52CD	3F77	C39A	77AF	32BD	7296	84DD	. <r.?2< td=""></r.?2<>
180930	21BF	72FD	2121	70FD	3600	0121	3072	7EFE	111618
180948	2928	2DCD	C57A	9E91	FD34	8823	7EFE	2928	. (4.1(
100950	030C	104F	DD7E	9589	3891	7900	7785	1106	
100968	0000	193A	BD7 2	3C32	ep72	FE28	3888	1884	:<2
100978	23FD	3499	19C8	CDFB	7621	803C	2220	4021	1.4
190989	FE75	CD27	5211	893D	CD57	52FE	Ø1CA	2152	'R=.WRIR
100998	FEGI	8258	7C82	CA4C	7CED	5332	7622	3476	XL\$2."4.
18C9A8	1149	3 DCD	5A52	FEBL	CA21	5279	3236	7611	.0=.ZR1R.26
10C9B8	603D	2137	76C0	5D52	FE@1	CA21	5278	3258	.=!7R1R.2X
180908	763A	E837	FEBS	381D	2190	3E22	2848	2148	.:.78.1.>".@IH
100900	75CD	2752	CD45	52CD	CE76	PEØ1	CA21		'R.ER!R.
10C9E0	9D28	DELS	EF					32.0	· · · · · · · · · · · · · · · · · · ·
			21	003E	2220	4021	2475	CD 27	.(!.>".011"
18C9F8	52AF	32AC	7332	9175	21FF	FF22	EE5D	CD70	R.22!"
	LL			7213	2111		2275	0070	

Fig. 1. The Sector Display Minus the Spaces

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". . . if no printer is attached, or the driver program was omitted or overwritten, vour machine will hang up."

tion if the C register contains a 1, which is the computer's way of saying that the comparison matched).

Otherwise, the computer continues on its merry way down the instructions end we wind up with a Printer Not Ready message. We could have told it to jump there if the C register did not contain a 1, (JR NC,7CA8H is a jump if not); this can be done by typing the same Mod instruction, pressing the right arrow key 11 times and then pressing zero once, changing the line from: 381D, or in assembled form: 381D JR C,7CA8H, to: 301D, or in assembled form: 7C89 301D JR NC,7CA8H.

We changed the 38, which the computer understands as "jump if", to a 30, which tells it to "jump If not"-1D(hex) or 29 address locations, depending, in this case, on the value in C. If we had done it that way, and later hooked up a parallel printer, the value would have to be changed back again. or we would get a Not Ready message anywav.

If you want to do serial printing under the display/edit mode, (H)ardcopy option of Profile, one more change has to be made. The code contained in the Access program looks like this:

> A,(37E8H) 7311 3AE837 LD 7314 FE80 CP 80H 7316 3809 JR C.7321H 7318 210372 1 D HL 72D3H 731B CD8F72 CALL 728FH 731E C36471 JP 7164H

Still using NEWDOS and Superzap's DD option, select the drive number that the backup copy of Profile is in. For my copy. the track number was 1C, the sector was 3. If it isn't on yours, just match up the sector display with Fig. 2.

Locate the hex digits beginning with 3A (these are the numbers in the second through eighth columns of the listing, the group of six numbers in the first column is the hex address of the program location on the disk) and ending with 71. Fill these 32 places with zeros, and press Enter and Y to make the modification permanent.

You should now have a copy of Profile that will run with a serial printer. However, you should note that if no printer is attached, or the driver program was omitted or overwritten, your machine will hang up.

That wasn't so difficult, was it? And I really don't know how to program in machine language. All it took was a burning desire to get printed output, and some plowing into the Editor/Assembler manual. (And perhaps a truckload of perseverance!)

Now for T-BUG Users

It should be a lot easier for you, but I haven't tried to do it this way. Load the print program. Hold down the Break key and press the reset button. Get into the System mode and load and run T-BUG.

PRINT loads from 7000H to 7CFEH, T-BUG uses 4000H to 42E8H, so there is no conflict of memory. When the asterisk appears, type M 7C84. You should see: M 7C84 3A. Now type 00. The next memory location should be displayed: 7C85 E8. Again type 00 and keep doing that until you've gotten to memory location 7CA7. This is the last memory location you will zero out.

Press Break, put a blank tape in the cassette drive, set it up for recording and press P, T-BUG's Punch command, used to write memory locations to cassette. We need now specify a start address, end address and entry point, plus a name. The start address is 7000, the ending address is 7CFE. Here's where the fun starts.

According to NEWDOS, the entry point is 402D. Normally we would assume that a program's starting point and entry point are the same, but not necessarily. You'll have to try it both ways. Use Print as the program name. The punch line will look like this: P 7000 7CFE 4D2D PRINT, or P 7000 7CFE 7000 PRINT, depending on which entry ad-

110300	C370	71ED	4 BEE	5DCD	4B52	C3D2	71		
							ЭА	E837	KKR7
110310	FE86	3809	21D3	7 2 C D	8F72	C364			
		_					3 A		
							403C	0140	.28.>;1@<@
		C511	7073	0140	00 E O	B@E5	EB2B	0640	2
		2020	0826	10F8	2170	7306	0123	0436	+!
	ØD21	7073	7 ECD	3600	2310	F9E1	C110	0386	.1;.#
11C36Ø	Ø53E	ØACD	3B 00	3E00	CD36	0010	F4C3		.>;.>;
11C370	0182	B173	3AF1	5DB7	2009	21C6	72CD		
11C3BB	C364	7172	CØ3F	2220	4021	1C5E	CD27		!.?".@!'R.
11C390	4552	FE59	28 0 4	FE4E	20F5	CDBØ	67 F E		ER.Y(NN.
11C9A#	7071	3AEF	5A30	4721	9D55	36CB	2310	FRED	:.Z=G1.U6.#
11C9BB	4BEE	5DCD	4E52	2AED	5A23	22ED	5A21	9056	KNR*.Z**.Z1.V
11C9C#	CD2A	52CD	2752	AF32	F15D	3E01	32E9	5DC3	.*R.'R.2>.2
110900	6471	1140	3FCD	5752	FEØ1	CA64	71FE		0?.WR
11C9E0	6471	ED53	0D71	220B	7111	803F	CD5A		S "?.ZR.
11C9F0	Ø1CA	6471	0132	3174	7932	1071			212?!
								V- 2-2	
	11C3BB 11C390 11C9AB 11C9BB 11C9CB 11C9CB	11C310 FE88 11C328 FE32 11C338 3273 11C340 7EFE 11C350 0D21 11C360 053E 11C378 B102 11C38B C364 11C390 4552 11C9A0 7871 11C9B0 4BEE 11C9C0 CD2A 11C9D0 6471 11C9E0 6471	11C310 FE8B 3809 11C32B FE32 3BB5 11C33B 3273 C511 11C340 7EFE 2B2B 11C350 0D21 7073 11C360 053E 0ACD 11C37B B102 B173 11C3BB C364 7172 11C390 4552 FE59 11C9AB 7B71 3AEF 11C9EB 4BEE 5DCD 11C9CB CD2A 52CD 11C9CB 6471 1140 11C9E0 6471 ED53	11C310 FE8B 3809 21D3 11C32B FE32 3BB5 3EBC 11C33B 3273 C511 7073 11C340 7EFE 2B2B 6826 11C356 0D21 7073 7ECD 11C360 053E 0ACD 3BBB 11C37B B102 B173 3AF1 11C3BB C364 7172 C03F 11C390 4552 FE59 2804 11C9AB 7B71 3AEF 5A3D 11C9EB 4BEE 5DCD 4E52 11C9CB CD2A 52CD 2752 11C9CB 6471 1140 3FCD 11C9EB 6471 ED53 0D71	11C310 FE8B 3809 21D3 72CD 11C32B FE32 3885 3E8C CO3B 11C33B 3273 C511 7073 8140 11C340 7EFE 2828 6826 16F8 11C356 0D21 7073 7ECD 3888 11C356 053E 0ACD 3888 3E8D 11C378 8182 8173 3AF1 5DB7 11C38B C364 7172 C03F 2228 11C390 4552 FE59 2804 FE4E 11C9A8 7871 3AEF 5A3D 4721 11C9B8 4BEE 5DCD 4E52 2AED 11C9C8 CD2A 52CD 2752 AF32 11C9E0 6471 ED53 0D71 2208	11C310 FE8B 3809 21D3 72CD 8F72 11C320 FE32 3805 3EBC CD3B 8006 11C330 3273 C511 7073 8140 80ED 11C340 7EFE 2020 0826 10F8 2170 11C350 0D21 7073 7ECD 3680 2310 11C360 053E 0ACD 3B80 3EBC CO36 11C370 0102 B173 3AF1 5DB7 2009 11C370 0102 B173 3AF1 5DB7 2009 11C380 C364 7172 C03F 2220 4021 11C380 C364 7172 C03F 2220 4021 11C9A0 7871 3AEF 5A30 4721 9055 11C9B0 4BEE 5DCD 4E52 2AED 5A23 11C9C0 C02A 52CD 2752 AF32 F15D 11C9D0 6471	11C310 FE8B 3009 21D3 72CD 8F72 C364 11C328 FE32 3885 3E8C C03B 8006 6821 11C338 3273 C511 7073 8140 80ED 80ED 11C340 7EFE 2028 602e 10F8 2176 7386 11C350 6021 7073 7ECD 3888 2310 F9E1 11C360 633E 6ACD 3888 3E80 C036 6018 11C378 8102 8173 3AF1 5DB7 2809 21C6 11C38B C364 7172 C03F 2228 4021 1C5E 11C380 4552 FE59 2804 FE4E 20F5 CDB0 11C9A0 7871 3AEF 5A30 4721 9055 36CB 11C9B0 48EE 5DCD 4E52 2AE0 5A23 22ED 11C9C0 C02A 52CD 2752 AF32 <th> 11C310</th> <th> Tebra Tebr</th>	11C310	Tebra Tebr

Fig. 2. The Sector Display for ACCESS Minus the Spaces



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"Always experiment on backup copies of data... Tattoo that on your arm somewhere."

dress you've used. Press Enter and the tape should start recording the progrem. Now go back to DOS and run TAPEDISK to create a disk file with the same Print.

When you've done thet, or if you find that the entry address doesn't work, turn the expension interfece and the CPU keyboard off. Take any disks out of the drives first: this will ensure that all memory locations start up clear. You should then repeat the procedure for Access, modifying addresses 7311 to 7320 with 00 as in Print. Again we are faced with the entry point problem, giving us the following punch lines: P 7000 7460 402D ACCESS or P 7000 7460 7000 AC-CESS. You don't heve to press Enter this time, since the file name is six characters long. Make sure there is e blank tape in the cassette recorder set for record before you type this out. T-BUG starts the process autometically. Run TAPEDISK again, creeting the file Access.

When you creete the disk file, do not use an extension (/CMD, /BAS, whetever) on the file name. You may specify the destination drive. When you're creating the tape file, meke sure you start the tape on the tape end not on the leader. I only mention this because I've done it myself. There you have it. See, it was easier than using NEWDOS (maybe). Remember, even hete mail costs money to send.

Data Manipulation

You still can't specify e range of dete within the dete base. (Please remember that although Microfiles is advertised es creating a data base, it actually compiles only a data set, not something that can be accessed, end the dete menipuleted, used. or modified by en alien program source as mey a true date base.) Nor can the dete be ected upon in any way but the ways imposed by Profile. But hang in there.

When Profile initializes the disk it grebs up all the aveilable spece it can and formats the disk as if it had files to store there. Take a look et Fig. 3. If you get the chance to . look at e formetted diskette, you will notice that the only data is coded E5. See the dilference? Think of the asterisks es cleim merkers that Profile uses to mark off disk space. It's e shame ell those neef rows of asterisks have to be spoiled by the periods.

Notice that the data stored is 2A, end es long as there is a 2A there is an asterisk. When we have a period, there is an OD, If we reelize that 2A is a hexedecimal number whose decimal equivelent is 42 (2.16 + 1-10), end then look at pege C/2 in the Level Il manual, we would see that 42 is the ASCII decimal code for an asterisk. OD, on the other hand, is decimel 13 (16.0 + 1.13), and that's a carriage return (where there is an

ASCII character evalleble for the code displeyed, we see it: where there is none. Superzap pieces a period in the spot). Wouldn't it be nice if there was a function in Basic thet creetes a string like thet, and something in Disk Basic that handles such a file? Oh, but there is! Ever hear of line input? Let me quote to you those blessed words from the Book of DOS, chapter 7. verse 42:

LINEINPUT (or LINE INPUT-the space is optional) reads everything from the first character up to:

- 1) an <EN> character not preceded by <LF>
- 2) the end-of-file
- 3) the 255th data character (this 255th character is included in the string)

Although the TRS-80 generates a line feed (LF) with a cerriage return, only the carriage return is stored (OA is the hex value of a line feed). We seem to setisfy the requirements of line input for data retrieval from disk and at the same time, enswer the burning question why we cannot store more than 255 characters.

Take a look at Fig. 4. It shows a sample set of data filed using the fields we specified at the beginning of the article. As usual, the first column of six numbers is the disk storege location of the dete. If we go back for a moment to the file we set up end count the total elements in all the flelds, we'll find our file length is 63 characters, if we then count out 63 hax numbers (each hexedecimel number is a pair, so the first line contains 16 numbers, the first of which is 49, followed by 4E, 20 and so on), at the end of 63 of them we find our friend OD. To read this data all we have to do is write a program:

- 100 OPEN "I", 1, "PRODAT:O":REM IF PRODAT IS ON **GRIVE O**
- 110 PRINT"DO YOU WISH TO ACCESS A FILE?"
- 120 A\$ = INKEY\$:IF A\$<>"Y" AND A\$<>"N" THEN 120

- 130 IF A\$ = "N" THEN 210
- IF EOF(1) THEN PRINT "ENO OF FILE 140 REACHED":GOTO 220
- LINE INPUT#1, QATAS
- 160 IF LEFTS(DATAS,1) = "+" THEN PRINT "END OF DATA" GOTO210
- IF LEFTS/DATAS 1) = CHRS/192) THEN PRINT "DELETEO FILE": FOR X = 1 TO 500:NEXT X:CLS **GOTO 140**
- 180 PRINT DATAS
- PRINT"ANOTHER 2" 190
- 200 AS = INKEYS:IF AS<>"Y" AND AS<>"N" THEN 200
- IF AS = "Y" THEN CLS:GOTO 140 210
- 220 CLS:CLOSE:END

This is the skeleton of a sequential eccess program that cen be used to read the disk date. We can customize the program to search for a particular value contained in the 64 character string (63 data characters plus the carriage return) using MIDS. To hendle the dete, we would egain use the MID\$ function to break down the main string into substrings. We could then convert any numeric data we need from string form with the VAL function. Unfortunately, it's not simple to use sequential access to write to the disk file. We would heve to input all the dete, modify it, and then rewrite the entire file back to disk again. Otherwise, writing to disk under that mode would set the pointer back to the beginning of the file and all stored information would be lost. Always experiment on beckup copies of deta. If you make a mistake, the data will still be available. Tattoo that on your arm somewhere

Suppose we wish to write some modified data to the file without entering Profile, using rendom access techniques. When we deal with random access, we retrieve or store dete with the GET and PUT commands 256 character buffers. When we deal with less data than would fill a buffer, we can form the small data packets into e large group, using an arrey that will fill the buffer more efficiently. Using the same array, we cen also retrieve the data.

```
166168
             2A2A
                    2A2A
                            2A2A
                                    2A2A
                                           2A2A
                                                   2A2A
                                                           2A2A
                                                                   2A2A **********
166116
186128
186138
                            2A2A
2A2A
                                                   2A2A
2A2A
             2A2A
2A2A
                    2A2A
2A2A
                                    2A2A
2A2A
                                           2A2A
2A2A
                                                           2A2A
                                                                   2A2A
                                                           2A2A
                                                                         *********
                                                                   2A80
```

Fig. 3. The INFOFILE acquires disk space by filling vacant files with asterisks.

```
116566
116516
                   2948
                          4F43
                                  4828
                                                2E26
                                                       494E
                                                               432E IN.HOCK.CO..INC.
362F ..... #55211#6/
                   2028
                                                3231
                          2020
                                 2836
                                         3535
                                                       3136
                   2P30
                          3036
                                  3031
                                         382F
                                                3437
                                                       2628
                                                               4E2F 12/800663.68..N/
116538
                                        2E2E
                                                              2880 A.....
                                                2E2E
                                                       282E
```

Flg. 4. 63-Character File

"None of the MK functions allow for the storage of a single byte; it must be converted using ASCII."

By accident, our file contains a total of 63 characters plus the CR. Coincidentally, 64 can be divided into 256 an even four times. If we planned to use random techniques, we should make sure our data adds up to a number that, plus 1, will be evenly divisible into 256, as the Profile manual suggests. That means 3, 7, 15, 31, 63, 127 or 255. (Profile tiles are dumped to disk one after the other. If we try to access a file that does not conform to the above lengths we will find each buffer's remainder contains data which will be left out of the next GET call.) We could use a program like this:

100 Open "R", 1, "PROOAT:0"

120 EF = LOF(1)

130 FOR PF = 0 TO 3

140 FIELO 1, (PF-64) AS DUMMFILES, 63 AS OATAS

150 NEXT PF

160 INPUT"FILE NUMBER: ";N

170 IF N> EF-4 THEN PRINT "OUT OF RANGE":FOR X = 1 TO 500: NEXT X:CLS: GOTO 160

180 FP= ((N·1)/4) + 1

190 PN = N-((FP+4)-3)

200 GET 1, FP

210 IF LEFTS(OATAS(PN),1) = CHRS(192) THEN PRINT "DELETED FILE":FOR X = 1 TO 500: NEXT X:CLS: GOTO 160:REM CHR\$(192) IS USED TO FILL THE POSITIONS IN A DELETED FILE

220 IF LEFT\$(DATA\$(PN),1) = "#" THEN PRINT "NO SUCH FILE": FOR X = 1 TO 500: NEXT X:CLS: **GOTO 160**

230 PRINT OATAS(PN)

240 PRINT"ANOTHER...?"

250 A\$ = INKEY\$:IF A\$<>"Y" AND A\$<>"N" THEN 250

260 IF AS = "Y" THEN CLS:GOTO 180

270 CLS: CLOSE: END

Again, it's a skeleton program. Flesh it out for specific fields, to change drives if more than one is used for storage and to search for particular pieces of date in string.

Infofile

Did I just say "change drives"? How the heck can the program know if I have more than one drive? Allow me to introduce you to Fig. 5a. This is a section of a diskograph for another file created by Profile, called Infofile

The first pair of hex digits (a hex peir is called a byte) 18, convert to decimal 24. It just so happens that in this file I have stored 24 records. In fact, the first two bytes in this record of Infofile contain the number of records currently in the Prodat file. It is saved to disk using the MKIS in a random file mode, since it will always be an integer, it it had a numeric value larger than one byte (not simply 1800, which has no value in the second byte), if would not necessarily have been directly readable without using the alternate CVI function to reconvert it to a numerical value.

The next two bytes (A007) are the MKI\$ converted value for the maximum allowable number of files, followed by the single byte, 01, which is the maximum drive number. (This value is stored as CHR\$(n) where n is the maximum drive number. None of the MK functions allow for the storage of a single byte: it must be converted using ASC.) The two bytes, 0000, note that there are no deleted records in this file. Had there been any, their number would have been stored here. The next piece of data, 40, is the length of the record, 64 (63 characters for the file data plus the carriage return). As with the maximum drive number and the following byte, 07, (which is the number of fields assigned at initialization) this was stored as a CHR\$(n) and can be converted to its numeric value with the ASC function. The last four byte pairs tell us what the highest file number is on drives 0, 1, 2 and 3 respectively.

Fig. 5b Is the second sector of Infofile, showing our field names and a small amount of additional data. The first 13 bytes are atlotted to the field name itself, while bytes 14 and 15 are the MKI\$ equivalent of the screen print position, plus 15360. (Therefore, if printing to the screen we would use Print @, CVI(x\$)-15360.) Byte 16 is the length of the field. If we look at the

0000e.... F00000 F00010 1800 00DC A007 559D 877B 829F 0700 0100 004 B 0500 0000 8998

Fig. 5a. The first set of numbers, 18, is the hex equivalent of 24, the total number of files on record.

	F80180	4143	434F	554E	5420	4E41	4D45	284€	3C17	ACCOUNT. NAME.N<.
ı	F00110	494E	564F	4943	4523	2020	2020	200E	3C86	INVOICE#
	F88128	4441	5445	2020	2829	2020	2020	20CE	3C88	DATE
Ì	F00130	414D	4F55	4E54	20 20	2020	2829	200E	3007	AMOUNT
l	F00140	584F	2F4A	4F42	2320	2828	2020	204E	3D87	PQ/JOB#N=.
Ì	F00150	584F	5354	4544	2F50	4149	4428	208E	3000	POSTED/PAID = .
l	F00160	4340	4543	4B23	2020	2820	2028	20CE	3DØ4	CHECX #

Fig. 5b. The Second Sector of INFOFILE, Showing the Titles of the Established Fields

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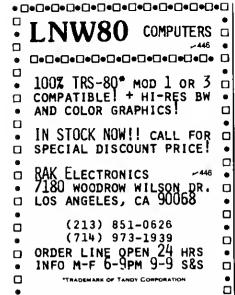
FLOPPY

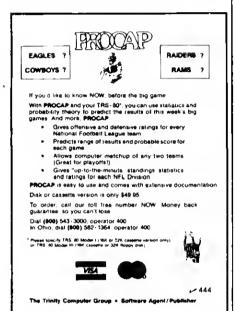
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"The user's manual gives a great program for extracting this data from a specified file number."

line that contains the field Account Name, we see the final byte is 17, 23 decimal, the length of our entry for that field.

Procedures

The first thing we must do is define some variables. We'll use the ones that are provided in the Profile user's manual:

NR The Number of Records in Prodat, including any deleted records

The Maximum Number of Records Allowed

DO The Maximum Drive Number

The Number of Fields in the Record

D(I) "I" is an Integer between 0 and 3, D(I) is the

highest record number stored on disk

And now some program lines:

100 CLS: CLEAR 1000 110 OPEN "R",1, "INFOFILE:0" 120 FIELO 1, 2 AS NR\$, 2 AS MX\$, 1 AS MD\$, 2 AS DR\$, 1 AS RL\$, 1 AS NF\$, 2 AS D\$(0), 2 AS D\$(1), 2 AS D\$(1) 2 AS D\$(2), 2 AS D\$(3)

Usually when dealing with a random access file, we'd use an array to break down the elements in the 256 character buffer. However, here we are only interested in the elements we need for the program.

130 GET 1,1
140 NR = CVI(NR\$): MX = CVI(MX\$): MD = ASC(MD\$):
NF = ASC(NF\$): FOR DN = 0 TO 3: D(DN) = CVI(D\$
(DN): NEXT DN

Normally, we would then get the second buffer and discover the field names and lengths. The user's manual gives a great program for extracting this data from a specified file number. As we already know these things, we can bypass that section.

150 CLOSE 1

We will assume that the first 90 lines of the program load all the account names and eddresses into a matrix in memory, MASTERLIST\$, which will be used to coordinate the data from PRODAT. (Otherwise, we should have three disks on line, two for Profile and one for the account data.) In the program lines that follow, we will use the variable EF to indicate the numeric position of the final entry in MASTERLIST\$ and the

variable RP to indicate any intermediate relative position within the matrix.

160 DN = 0 : DN\$ = STR\$(DN)
170 OPEN "R",1, "PRODAT:";DN\$
180 FOR ! = 0 TO 3
180 FIELD 1, (I-63) AS DUMMYSTRING\$, 23 AS NM\$(I), 6 AS IN\$(I), 8 AS DT\$(I), 7 AS AM\$(I), 7 AS PO\$(I) 8 AS PD\$(I), 4 AS CK\$(I)
200 NEXT I

Now use the data in Masterfile\$ to check out the status of the accounts stored in PRODAT.

210 FOR RP = 1 TO EF
220 FOR BN = 1 TO INT(D(DN)/4)
200 GET 1, BN
240 FOR I = 0 TO 3
250 IF LEFT\$(NM\$(I),1) = CHR\$(42) THEN 280
260 IF LEFT\$(NM\$(I),1) = CHR\$(192) THEN 1000
270 IF NM\$(I) = MASTERFILE\$(RP,1) AND LEFT\$(PD\$(I),1)
= "." THEN 2000
280 NEXT I, BN

Line 250 procedes to the next record in the subfile if the entry being currently examined was deleted. Line 260 sends the program to e controlled error message if the end of the stored data has been reached and no information has been recovered for a given account name.

The loose end, lines 2000-xxxx, is merely a print statement that will send the information to our line printer (formatted to reflect page number of account statement on a per account basis) and performs the addition necessary to give total due amounts.

Fig. 6 is a small program for single disk users that will read each of the Prodat entries over a given range of dates (for instance, if you wanted the entries for August you would use 08/00/80 in response to the Greater Than question and 09/00/80 for the Less Than prompt), print the account name, invoice number and amount with pagination and, when done, print the total amount involved. More fields for manipulation can be specified and other actions performed

Program Listing

18 CLEAR 1058
30 CLS:OPEN "R",1, "PRODAT:0"
50 EF=LOF(1)
60 DIM F\$(EF)
76 FOR J=0 TO 3
90 FIELD 1, (64*J) AS DUMMY\$, 63 AS F\$(J)
110 NEXT J
115 PRINT 0 320, "MONTH OF: ";:INPUT M\$:CLS

Program continues

"But what good is collecting information if you can't do whatever you want with it?"

```
Program continued
              120 PRINT @ 320, "DATE RANGE:";:INPUT"GREATER THAN:
";GTS:PRINT @ 448,"";:INPUT"LESS THAN: ";LT$
              130 CLS
               100 FP=1
              190 GET 1,FP
              195 FOR RP=0TO3
              197 IF LEFTS(F$(RP),1)=CNR$(42) THEN 290
199 IF LEFTS(F$(RP),1)=CHR$(192) THEN PRINT T:GOTO 202
200 IF RIGHTS(F$(RP),4)="...." ANO
              MIDS(FS(RF), 30,8)>GTS AND MIDS(FS(RP), 30,0) <LTS THEN
              GOSUB 400 ELSE 202
201 NS=LEFTS(F$(RP),23):INS=MID$(F$(RP),24,6):AN=
VAL(MID$(F$(RP),30,7)): T=T+AM:LPRINTN$;"
";IN$;"
"::LPRINT USING"#6##.##";AM: LS=LS+1:
              IF LS>50 THEN 500
              202 NEXT RP
              204 FP=FP+1:IF FP>EF THEN 290
              210 GOTO 190
              290 LPRINT
               300 LPRINT
                ;:LPRINT USING"$$###.##";T
              310 CLOSE
320 END
400 IF FL>0 THEN RETURN
              410 PN=PN+1:FOR X=1TO2: LPRINTCHR$(13); :NEXTX :LPRINT"COPYQUICK<LF>107 EAST 42ND<LF><LF> CHARGE DATA MONTH OF ";N$;"
              PAGE
              415 LPRINT USING ####"; PN:LPRINT "<LF>";:LPRINT "ACCOUNT
                                                 INVOICE#
              AMOUNT": FL=1: RETURN
              500 FORX=1T06:LPRINTCHR$(13);:NEXTX:FL=0:GOTO202
```

on the data by simply following the pettern the progrem provides.

That's it. Those few lines are all it takes to turn Profile into more than just an overpriced in-memory Information system for disks. We now have available to us a feature seen on many, if not all, of the large multi-user computers: an accessible data base of information! For a reletively small machine such as the TRS-80 that is some accomplishment!

If you're not a business and have no accounts receivable to take care of, don't think you can escape Protile. Do you collect comics? Magazines? Computer Programs? What about all you CB and amateur radio operators? Want your logs up to date?

Forget about Microfiles, Ita' expanded entry formatting is very nice if all you want to do is enter data and recall it according to the parameters present in the program itself. But what good is collecting information if you can't do whatever you want with it?

Profile gives you this edded flexibility, and at a cheaper price. (isn't that against the law?)■



A home inventory program that remembers the little things.

Wordly Goods

John E. Fail 6170 Downey Ave. Long Beach, CA 90805

ave you ever wondered about the possibility of your house being burglarized or burning down? We live with this possibility every day whether we are at home or not. In the event of such a catastrophe your insurance should cover the loss. However, when the insurance man comes to call, will you be able to accurately recail all the items you have lost? Chances are you will remember the tv set, the couch, the computer, the major items in your household; it is the little items you will not easily recall—tools, pictures, jewelry and the like.

This program, for a 48K system with two disk drives, catalogs 300 items per room and provides a line printer routine.

Depending on the total Items in your inventory, you could utilize one file for all items in your household. Included in the program are full correction and deletion routines. Categories included in an individual file are: location; item; data purchased;

Fall Family Household Inventory

Oirectory

- 1 = Load Data From Disk
- 2 = Look at List for Living Room
- 3 = Save Oata on Disk 4 = Printout of Data on File
- 5 = Delete an Entire Entry
- 6 = Correct an Entry
- 7 = Add Entries to File
- 8 = Print Total Value of Living Room
- 9 = Item Search by Name

Your Selection Please?

Fig. 1 Directory Layout

initial cost; business the item was purchased from; serial number; and comments.

The program is straightforward, user oriented and prompting at all points. The scheme is to set up individual files on a separate disk by room. The other alternative is to file your inventory on the program disk providing the inventory is not too large. The inventory program can be used by 32K systems by adjusting the clear statement in line 20 and the dimension statements in line 25. Line 30 should be changed to fit your family name.

After you have run the program, entered files for your inventory and are ready to save to disk, you will be prompted by the program to provide a filespec for writing to disk. This list of filespecs will be provided just prior to loading from or to disk. The user should change lines 13010 and 13020 to his or her own filespec if those in the program are not acceptable.

A word of caution—plenty of string space is provided in the clear statement in line 20, however, don't get too carried away with large comments or string apace will be used up fast.

When first running the program and entering files, the first item entered will cell for a location. No further locations will be asked for during the course of the entries. The program will automatically print that location in all entries after number one. If you are not using separate files for all rooms in the house but use one file for the entire household, a single filespec will be used to answer the location question. On the first entry use a word such es "household." If

	Inventory for Living Room			
Number	Item	Cost	Mfr/Dealer	Date
1.	Couch	\$ 995.00	Sears	02/05/81
	Serial Number: None			
	Comments: Gold with Flower Patterns			
2.	Chair	\$ 140.00	Sears	03/01/81
	Serial Number: None			**********
	Comments: Gold with Flower Pattern (Set of 4)			
3.	Television	\$1000.00	Dooleys	04/01/80
	Serial Number: 43566981			0410100
	Comments: Motorola Model 333-8799.1			
4.	Lamp Floor	\$ 40.00	Sears	01/01/81
	Serial Number: None			01,01,01
	Comments: With Shade			
	· · · · Continua 'C' Finished 'F' · · · · ?			
	Fig. 2 Print List Sa.	mole		

you are using separate files for each room, assign that room's name to the location question and separate the rooms by filespec when saving and loading from disk.

vent locking up the program in case of inadvertently going to that function. This program can also be used by cassette-based

systems merely by changing the 1000 and 3000 series of line numbers to accommodate cassette I/O.■

Search, Delete and Correct

The search section is based on key words. When seerching for an item, the item variable is compared against the first three letters of the seerch request input. For example, suppose you have three chairs in a room. When you are requested for an item to search for, enter chair. The program will then search out the first chair encountered and print it out. The program will then ask if this is the correct chair; if not, the program will continue the search. If no comparison is found, the program will so advise you. When entering data into the item section, use the major subject first, such as chair, couch, television, computer. If you still cannot find the item you are looking for there is always the 'Look At List' function on the menu to locate an item.

The deletion routine is very straightforward. When an item is deleted, all other items are moved up one to fill the space left by the deleted item. When the deletion routine is called, the program will check with you to be certain you are indeed deleting the item you wish to delete.

The correction routine operates much like the deletion routine. It checks to make sure this is the item you wish to correct, and then displays an input form similar to the normal entry input routine. You need only enter the portion to be corrected. If the item, cost and dealer information is correct and you only went to enter a new serial number, merely press Enter for the items you do not want to change and enter the new data in the serial variable. All information in the other columns will remain unchanged.

The Line Printer Routine

The line printer routine is set up for 80-column printers to maintain compatibility with most any printer in use these days. The printer function is very handy for keeping a permanent record of the inventory. You can run out a copy of each listing and keep it in a sate place, such as a friend's home, your piece of employment, or a safe deposit box. This ensures the list will not disappear with the house or burgler. It may be a good idea to keep a separate copy of the program disk and data disk outside the home elso. The listing automatically prints "a value of room routine" at the end of the printout. This function is also available on the video for a quick check of the total value without a printout.

Readers without line printers should remove the 4000 series of line numbers to pre-

Page: 1	Last Revision: 6 April 1981				
Number	item	Cost	Mfr/Dealer	Date	Serial Number
1.	Couch	\$ 995.00	Sears	02/05/81	None
	Comments: Gold with Flower Patterns				
2.	Chalc	\$ 140.00	Sears	03/01/81	Nona
	Comments: Gold with Flower Pattern (set of 4)				
3.	Television	\$1000.00	Dooleys	04/01/80	43566981
	Comments: Motorola Model 333-8799.1				
4.	Lamp Floor	\$ 40.00	Sears	01/01/81	None
	Comments: With Shade				
5.	Lamp	\$ 100.00	Wards	02/02/81	Nona
	Comments: Matched set of 2 Table Lamps				
6.	Clock Digital	\$ 30.00	Seers	12/25/80	322479
	Comments: With Alarm and FM Radio				
7.	Table	\$ 140.00	Sears	02/02/81	None
	Comments: Coffee Table with Glass Top				
8.	Stereo System	\$ 600.00	Wards	09/16/81	5559091
	Comments: With 50-60 Records in Cabinet				
9.	Painting	\$9999.00	Art Shop	01/01/81	None
	Comments: The Mona Lisa Original by Da Vinci				

Fig. 3 Line Printer Print Sample

Program Listing

```
20 CLEAR25000:T=300:US="$****.**":VS="$**,***.**"
25 DIMLS(300),IS(300),C(300),DS(300),MS(300),SS(300),COS(300)
30 BS=LS(1):SK=0:SW=0:CLS:PRINTTAB(15) "FAIL FAMILY HOUSEHOLD INV
ENTORY": PRINTSTRING$(63, "="): PRINTTAB(24) "DIRECTORY": PRINTSTRING
$(63, "="):PRINT"1 = LOAD DATA FROM DISK":PRINT"2 = LOOK AT LIST"
35 PRINT@337, "FOR "; 8$
40 PRINT"3 = SAVE DATA ON DISK": PRINT"4 = PRINTOUT OF DATA ON FI
LE": PRINT"5 = DELETE AN ENTIRE ENTRY": PRINT"6 = CORRECT AN ENTRY
50 PRINT"7 = ADD ENTRIES TO FILE":PRINT"8 = PRINT TOTAL VALUE OF
55
   PRINT0729.BS
57 PRINT0760, "9 = ITEM SEARCH BY NAME"
60 PRINT0032,STRING$(63,"=")
70 PRINT:PRINT0096,"YOUR SELECTION PLEASE";:INPUTA:IFA<lORA>9GOT
030
80 ONAGOTO1000,2000,3000,4000,5000,6000,7000,0000,9000:GOTO30
1000 'LOAD FROM DISK ROUTINE
1020 GOSUB13000
1025 CLS:PRINTTAB(20) "LOAD FROM DISK ROUTINE":PRINT@440, "PLACE D
ATA DISK IN DRIVE AND PRESS ENTER";: INPUTAS
1029 ONERRORGOTO14020
1030 OPEN"I",1,FS$
1040 CLS: PRINT@440, "LOADING FILE #"
1100 FORL=ITOT
1110 PRINT@462.L
1160 INPUT#1,L$(L),I$(L),C(L),M$(L),D$(L),S$(L),CO$(L)
1100 IPEOF (1) THEN 1900
1500 NEXTL
1900 CLOSE
1990 B$=L$(1)
1999 GOTO30
2000 'LOOK AT LIST ROUTINE
2010 BS=LS(1)
2020 GOSU812500
2025 H=0
2030 FORL=1TOT
2035 IFLEN(L$(L))=0THEN12700
```

Program continues

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```
Program continued
```

```
2036 IFSK=landLen(L$(L)) = 0THEN PRINT 0446. "NO DATA ON FILE FOR ITE
H #"; ID; PRESS ENTER";: INPUTA$: GOTO5100
2030 IFSW=lANDLEN(L$(L))=0THENPRINT0440, "NO DATA ON FILE FOR ITE
H # "; ID; PRESS ENTER";: INPUTA$: GOTO6000
2040 PRINTL"."; TAB(7) I$(L);: PRINTTAB(29) USINGU$; C(L);: PRINTTAB(4
1) H$(L); TAB(54) D$(L): PRINTTAB(7) "SERIAL NUMBER: "S$(L): PRINTTAB(
7) "COMMENTS: "CO$(L):H=H+3:IFH=12GOSUB12500
2045 IFSK=1GOTO5050
2050 JFSW=1GOTO6050
2000 NEXTL
2999 GOTO30
3000 'OUTPUT TO DISK ROUTINE
3005 GOSUB13000
3010 CLS: PRINTTAB(15) "OUTPUT DATA TO DISK ROUTINE": PRINT@440, "PL
ACE DATA DISK IN DRIVE AND PRESS ENTER";:INPUTA$ 3020 CLS:PRINT@440,"SAVING FILE #"
3025 OPEN"O",1,FS$
3030 PORL=ITOT
3040 PRINT8461,L
3070 IFLEN(I$(L))=0THEN3990
3075 L$(L) =B$
3060 PRINT #1, CHR$ (34); L$ (L); CHR$ (34); CHR$ (34); I$ (L); CHR$ (34); C(L); CHR$ (34); H$ (L); CHR$ (34); CHR$ (34); D$ (L); CHR$ (34)
3090 PRINT#1, CHR$(34); S$(L); CHR$(34); CHR$(34); CO$(L); CHR$(34)
3990 CLOSE(1)
3999 GOTO30
4000 'LINE PRINT ROUTINE
4010 CLS:PRINTTAB(15) "LIHE PRINTER PRINTOUT ROUTINE":PRINT:PRINT "ENTER THE DATE TODAY";:INPUTDA$
4015 PRINT:PRINT"SET PRINTER TO WIDE CHARACTERS AND PRESS ENTER"
:: INPUTLPS
4020 CLS:PG=0:GOSUB12000
4025 PRINT0640, PRINTING ITEM #:"
4030 FORL-ITOT
4035 PRINT@656,L
4030 PRINTEGO,L

4040 IFLEN(L$(L)) = 0THEN 4230

4060 LPRINTL; "."; TAB(6) I$(L); :LPRINTTAB(20) USINGU$; C(L); :LPRINTT

AB(38) H$(L); TAB(53) D$(L); TAB(63) S$(L) :LC=LC+1: GOSUB14000

4065 LPRINTTAB(6) "COMMENTS: "CO$(L):LC=LC+1: GOSUB14000
4070 LPRINTSTRING$ (79, "-"):LC=LC+1:GOSU814000
4220 NEXTL
4230 SW=1:GOTO8000
4960 SW=0:LPRINT"":LPRINT"TOTAL VALUE OF ";BS;" ";:LPRINTUSINGV$
;RT:LPRINTCHR$(12)
4999 GOTO30
5000 'DELETE ENTRY ROUTINE
5010 SK=0:CLS: PRINTTAB(15) "DELETE ENTRIES ROUTINE": PRINT@440, "WH
AT IS THE ITEM NUMBER TO BE DELETED";: INPUTID
5015 IFID<10RID>300THEN5010
5020 CLS:SK=1:L=ID:H=0:GOSUB12500
5040 GOTO2036
5050 PRINT0448, "CORRECT ITEM TO BE DELETED (YES/NO)"::INPUTA$
5060 IFLEFT$(A$,1)="N"THENSK=0:GOTO5100
5065 CLS:PRINT0448, "DELETEING ITEM 1: ";ID
5070 FORX-IDTOT
5000 L$(X) =L$(X+1): I$(X) = I$(X+1): C(X) = C(X+1): H$(X) = H$(X+1): D$(X)
=D$(X+1):S$(X)=S$(X+1):CO$(X)=CO$(X+1)
5005 IFLEN(L$(X)) = 0THEN5100
5090 NEXTX
5100 CLS:PRINTTAB(15) "DELETE ENTRIES ROUTINE":PRINT0440, "DELETE
ANOTHER ITEM (YES/NO) ";:INPUTDKS
5110 IPLEFT$(DK$,1)="Y"GOTO5010ELSESK=0:GOTO30
5999 GOTO30
6000 'CORRECT ENTRY ROUTINE
6010 CLS: PRINTTAB(15) "CORRECT ENTRY ROUTINE"
6020 PRINT 0448, "WHAT IS ITEM NUMBER TO BE CORRECTED":: INPUTID
6025 IFID<10RID>300TREN6010
6030 SW=1:GOSUB12500
6040 L=ID:H=0:GOTO2038
6050 PRINT0448, "CORRECT ITEM TO BE CORRECTED (YES/NO)";:INPUTAS
6060 IFLEFT$(A$,1)="Y"THENCLS:SW=1:L=ID:PRINT@192,"ITEM # ";ID:G
OTO7114
6070 IFLEFT$(A$,1) = "N"THENSW=0:GOTO6080
6000 SW=1:CLS:PRINTAB(15) "CORRECT ENTRY ROUTINE":PRINT0448, "CHA
NGE ANOTHER ITEM (YES/NO)";:INPUTDK$
6090 IFLEFT$(DK$,1)="Y"GOTO6010ELSESW=0:GOTO30
6999 GOTO30
7000 'ADD ENTRIES ROUTINE
7010 CLS
7050 FORL=1TOT
7100 IFLEN(L$(L))=0THENPRINTTAB(15) "ADD ENTRIES TO LIST ROUTINE"
:PRINTSTRING$(63,"="):PRINT@192,"ITEM #";LELSE7900
7105 PRINT@192,"ITEM #";L
7110 IFL=1THENPRINT@256,"ENTER ROON:";:INPUTL$(L)
7115 IFL>1THENPRINT@256,L$(1)
7120 PRINT@328, "ITEM (19 MAX) ";: INPUTI$(L)
                                                                        Program continues
```


Yes, that's right - for as little as \$298.00 you can add 32K of dynamic RAM, and a disk interface, to your TRS-80 Color Computer! If you just want the extra memory it's only \$199.00, and you can add the disk interface later for \$99.00.

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Card uses normal TRS-80 Model I type disk drives, and CCDOS will even load Model I TRSDOS disks into your color computer - so you can adapt existing TRS-80 BASIC programs.

As a further plus, with the optional ROM Backup adaptor, you can dump game cartridges to cassette or disk. Once the ROM cartridge is on cassette, or disk, you can reload, examine and modify the software. The ROM Backup adaptor is only \$19.95.

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```
Program continued
7130 IPLEN(I$(L))>19THENPRINT@335,STRING$(40," "):GOTO7129
7140 PRINT@384,"COST (7 MAX I.E. 9999.99)";:INPUTC(L)
7160 PRINT@440,"MANUPACTURER/DEALER (11 MAX)";:INPUTM$(L)
7100 IPLEN(H$(L))>11THENPRINT@478,STRING$(20," "):GOTO7160
7200 PRINT@512,"DATE PURCRASED (MM/DD/YY)";:INPUTD$(L)
7210 IPLEN(D$(L))>9THENPRINT@539,STRING$(20," "):GOTO7280
7220 PRINT@576,"SERIAL # (14 HAX)";:INPUTD$(L)
723B IFLEN(S$(L))>14THENPRINT@594,STRING$(28," "):GOTO7220
724B PRINT@640,"COMHENTS (48 MAX)";:INPUTCO$(L)
7250 IPLEN(CO$(L))>40THENPRINT@59,STRING$(45," "):GOTO7248
7300 PRINT@896,"IS ABOVE DATA CORRECT (YES/NO)";:INPUTP$:IPLEPT$
(P$,1)="Y"THENPRINT@996,STRING$(40," ")
7310 IFLEPT$(F$,1)="N"THENL=L:CLS:GOTO7185
7310 IFLEPT$(F$,1) ="N"THENL=L:CLS:GOTO7105
7315 IFSW=1GOTO6000
7320 PRINT(096, "ENTER 'A' POR ANOTHER ENTRY. 'R' RETURN TO DIRECTORY";:INPUTG$
7340 IPG$="A"THEN7900ELSE30
7900 CLS: NEXTL
7999 GOTO30
8888 'TOTAL VALUE OF ROOM ROUTINE
8040 B$=L$(1)
9950 CLS:RT=0
8855 PRINT 8448, "TOTALING VALUE OF "; B$
007B PORL=ITOT
8090 RT=C(L)+RT
0130 NEXTL
0140 IFSW=1GOTO4980
8158 CLS:PRINT@448, "VALUE OF ";85;" ";:PRINTUSINGVS;RT:PRINT@968, "PRESS ENTER";:INPUTAS:GOTO38
0999 GOTO38
9880 ' SEARCH FOR ITEM ROUTINE
9012 GOSUB14050: PRINT0440, " NAME OF THE ITEM YOU ARE SEARCHING P
OR";: INPUTSES
9828 GOSUB14850: PRINT@448, "SEARCHING FOR "; SES
9040 FORL=1T0301
9045 IFL=301ORLEN(I$(L))=0THEN9250
9050 IPLEPT$(I$(L),3)=LEPT$(SE$,3)THENGOSUB12500ELSE92BB
9060 PRINTL".";TAB(7) I$(L);:PRINTTAB(29)USINGUS;C(L);:PRINTTAB(4
1) H$(L);TAB(54)D$(L):PRINTTAB(7) "SERIAL NUMBER: "S$(L):PRINTTAB(
7) "COMMENTS: "CO$(L)
9878 PRINTE448,"IS THIS THE ITEM YOU ARE LOOKING FOR (YES/NO)";:
INPUTSIS
9075 IFLEPT$(51$,1)="Y"THEN9100
9880 IPLEPTS(SIS,1) ="N"THENGOSUB14858: PRINT@448, "CONTINUE SEARCH
  POR "; SE$" (YES/NO) "; : INPUTSJ$
9090 ifLEPT$(5J$,1)="H"THEN9100ELSE9280
9100 GOSUB14050:PRINT0440, "SEARCH POR ANOTHER ITEM (YES/NO)";:IN
PUTSAS: IPLEPTS (SAS, 1) = "Y"THEN9018ELSE30
9200 NEXTL
9250 PRINTE448, STRING$ (40," "): PRINTE448, "NO PURTHER DATA AND/OR
 DATA ON PILE FOR "; SES: PORZ=1T01000: NEXTZ: GOTO9100
9990 GOTO30
9999 ENO
12500 CLS:PRINTTAB(20) "INVENTORY FOR "; B$:PRINTTAB(1) "#"; TA8(7) "
ITEM"; TAB(29) "COST"; TAB(41) "MPR/DEALER"; TAB(55) "DATE": PRINTSTRIN G$(63,"=") 1255B RETURN
12500 H=0:PRINT@900, "**** CONTINUE 'C' FINISHEO 'F' **** ;: IHPUT
12590 IFJ$="P"THEN3@ELSEGOSUB12508
12600 RETURN
12789 PRINT@968, "END DP LIST FOR ";B$; " PRESS ENTER";: INPUTK$: GO
12800 LC=0:PG=PG+1:LPRINTTAB(25) "INVENTORY FOR ";B$:LC=LC+1:LPRI
NT" ":LC=LC+1:LPRINT"PAGE: "PG; TAB(45) "LAST REVISION: ";OA$:LC=LC
12005 LPRINTSTRING$(79,"="):LC=LC+1:LPRINT" ":LC=LC+1
12010 LPRINTTAB(1)" * ";TAB(6)" ITEN";TAB(20)" COST";TAB(30)" NPR/DEA
LER";TAB(54)" OATE";TAB(63)" SERIAL 4":LC=LC+1:LPRINTSTRING$(79,"-
 ): LC=LC+1
12020 RETURN
13000 CLS:PRINTTAB(20) "PILESPEC KEYWORD LIST"
13010 PRINT:PRINT"THE FOLLOWING FILESPEC WORDS ARE AVAILABLE: ":P
RINT: PRINT RADIO ROOM = RADIORM PRINT LIVING ROOM = LIVINGRM:P
RINT"DINING ROOM = DININGRM"
13020 PRINT"KITCHEN = KITCHEN": PRINT"HASTER BEDROOM = MASBEORM":
PRINT"HIKES BEDROOM = HIKEROOM": PRINT"GARAGE = GARAGE": PRINT"PAT
IO = PATIO
13030 PRINT8960, "FILESPEC DESIRED";:INPUTFS$
13040 RETURN
14000 IPLC=60THENLPRINTETRING$(5,CHR$(10)):LC=0:GOSUB12000
14010 RETURN
14020 RESUME14030
14030 CLS:PRINT0460, ********* PILE SPEC ERROR ********* : FORZ
=1T01000: NEXTZ: GOT030
14050 CLS: PRINTTAB(19) "SEARCH POR ITEM ROUTINE": PRINTSTRING$ (63,
14060 RETURN
```

Poor Man's Floppy

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TC-8 Cassette System JPC Products Albuquerque, NM Kit: \$90 Assembled: \$120

by Carl A. Kollar

Iguess I don't have to tell any TRS-80 owners how frustrating the cassette system that comes with the computer can be. Even with the factory mod that's available, the annoyance of loading and checking programs becomes just barely tolerable.

If you're like me, after you've just plunked down a chunk of money for a Level II 16K machine, "you ain't got nuttin left" for even one disk drive at 500 bucks apiece. So you suffer.

A reasonable alternative is the Exatron Stringy Floppy (ESF). This will cost you about 250 bucks and totally eliminates your loading and saving problems, automatically and fast. I've had one of these for about six months and love it!

But, if the price is still too steep, have I got a device for you!

The Device

The February 1980 issue of Microcomputing had an ad that intrigued the hell out of me. It was a high-speed cassette system by JPC Products acclaimed as a "poor man's floppy." It made all sorts of seemingly ridiculous claims such as "loads five times faster," "stores 50,000 bytes on a 10-minute cassette," "less than one bad load in a million bytes with the volume control anywhere between one and eight."

All this for a measly [90] bucks? How could this be? A call to Albuquerque answered a few questions: Yes, it had its own power supply, and, it stored programs five times faster because it utilized higher density data. The computer outputs the information at a higher rate out of the rear keyboard connector.

The ad had even claimed anyone could build it even if you have never soldered before. JPC would make it work, if you couldn't—for free. I was sold. I placed my order, and it arrived about two months later (parts shortage).

I work in electronics, so I found the unit exceptionally easy to build. It took about an hour. The manual is superb. (That's better than great.) It was clear, concise and exact with no

ambiguities (managem) made pleasments are

ambiguities. Important parts placements are stressed (polarity markings on electrolytics, bands on diodes, etc.).

JPC was right! With these instructions, you couldn't go wrong. The board quality is excellent. It is double-sided and parts locations are clearly marked on the component side of the board. There are no jumper wires to install. JPC utilizes PC traces and plated-through holes for connections to traces on the other side of the board.

Also, there are absolutely no adjustments or settings to bother with.

The documentation is a sheaf of 8½ ×11 papers stapled together. It is written in the nicest format 1've seen in a while. Each command and/or subjects is covered on its own sheet in large type. All explanations are in easy to read English—not computerese.

Commands and Features

SAVE"filename": Saves your BASIC program on cassette.

LOAD: Reads the next BASIC program from the cassette.

LOAD"filename": Searches for and loads the specified file from cassette.

LOAD? and LOAD?"filename": Reads file from cassette, and compares contents to memory.

LOADN: Prints a list of all the programs on a cassette, until interrupted by the "break" key. LOADN"filename": Same as above except the tape will stop at the end of the program named. KILL: Removes the file manager program from memory so that the extra memory can be used by large programs.

RSET: Allows the operator to rewind and position the tape on tape recorders that have these functions tied to the motor control jack.

RUN"filename": TC-8 searches for a specified program and runs it immediately.

PUT"filename": Same as SAVE "filename", except it is for use with system tapes.

GET: Same as LOAD, except it is for use with system tapes.

GET"filename": Same as LOAD "filename", except it is for use with system tapes.

GET? and GET?"filename": Same as LOAD? and LOAD? "filename", except it is for use with system tapes.

GETN and GETN"filename": Same as

LOADN and LOADN"filename", except it is for use with system tapes.

OPEN: Required before cassette input or output of a data file can be attempted.

CLOSE: Required to end a cassette data file. PRINT#: Allows numerical or string data to be output to a cassette file.

INPUT#: Allows numerical or string data to be input from a cassette file.

I haven't counted them, so I don't know about the "one load in a million bytes" claim, but my son, Anthony (age 11), loaded about 30 of his programs from his Radio Shack format tape to a new TC-8 format tape. He's run them all and found no bad loads.

Unlike the standard tape system, you can position your tape anywhere before the program you want and not have to look for a blank spot between programs. The TC-8 patiently waits for the program you want and then starts loading without getting confused by the portion of the previous program you just fed it.

Try that on your regular cassette system; you'll wear out the reset button.

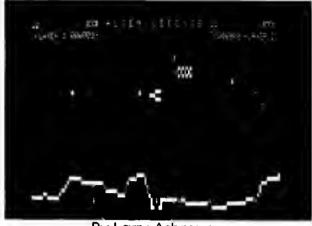
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To order your TC-8 kir, send your check or money order for \$90.00 plus \$3.50 postage and handling to JPC PRODUCTS CO., 12021 Paisano Ct., Albuquerque, NM 87112 (New Mexico residents add 4% sales (ax), Credit card orders accepted by phone or mail, Personal checks will delay shipment. We will otherwise immediately ship you the TC-8 kit, the cahinet, the ribbon cable, the power adapter, an instruction manual, and a cassette containing the software.

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Creative Computing, July 1981

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Metabasic—an end to the development of new languages.

A Macroprocessor For Basic—Part IV

J. Alan Olmstead J. Olmstead Finencial Engineering Systems 3813 West St., Moritz Lane Phoenix. AZ 85023

nless the Basic programmer is writing In native MataBasic mode, the Basic compiler will always be an "amulator" compiler (an amulator is a program which reads from one language and translates into a similar language). I wrote my first assembly language emulator in 1967 and can state flatly that no emulator can function with 100% accuracy. I do not write in MataBasic until the second state of program implemantation, praferring to "skatch out" tha outline of the program in fast and easy interpreter Basic. This is aspecially desirable for debugging tricky sections of logic. The Interpreter may be relatively slow, but the problems are caught right at the time that the subroutine is being written and is, accordingly, frash in the mind. That portion is than pracompiled into MataBasic and there are alweys datails to fuss over and change, as much out of style as out of necessity. After a trial compilation and execution under assembly language, any portions of the program which are not exactly as you intended may be written in pure assembly lan-

Programs should not be compiled for frivolous reasons. If the application is not time-dependent, is not in need of direct hardware controls for some operational reason, and is not subject to a concern for security, it should remain under interpreter Basic. Although not difficult, the technical environment involves so many details it's

not reasonable for anyone, at any level of experience, to expect to realize quick and easy results.

Preparation

Once determined a program needs compilation, preparation is required for the programmer and the program.

The programmer should be well-trained or experienced to the extent that he understands the workings of every Basic command word he uses without reference to the Besic manual. Understanding does not mean mere memorization; it includes an understanding of the conditions under which the instruction will produce its particular kinds of errors and "unspecified results." The programmer should be totally familiar with the compiler manual. The programmer should also know how the computer hardware works, including what the registers do and how they do it.

The program to be compiled should itself be prepared, keeping in mind that in the compilation process the complex and general are broken down into the elemental and explicit. Multiple-command lines should be broken apart. An error message directing one's attention to a line containing a half-dozen to a dozen commands is nearly as worthless as no message at all.

Error-trapping subroutines are most commonly deficient in applications and systems software, but they are among the most important program elementa. The purpose of arror-trapping generally is to prevent the uncontrolled termination of program execution by attempting to correct or work around a condition for which the pro-

gram or the operating system is not prapared. For exemple, when TRSDOS displays the Ready prompt, preceding the typed in response by a blank apace causes the system to respond "What?" If an otherwise valid sequence of characters is typed in which is not a functional command word, the system attempts to locate a program file by that name. Failing, it displays the "Program Not Found" message. Although part of the normal functioning of the TRSDOS program, these are actually error traps.

The best example of an untrapped error is illustrated in For... Next loops which reference an unverified third element (see Fig. 1). The non-trapped code is sure to fall at one time or other, while the trapped code cannot fail—at least due to the LEN(Y\$) as compared to the velues possible for "X" due to "A". This kind of trapping may comprise ten percent or more of a program.

Error-trapping for I/O files is particularly important, and the methods differ depanding upon the types of files and the types of access modes used for the files.

Most Basic programmers have never experienced a true program "blow up"; the closest they have experienced is e sudden and unexpected clearing of the screen and display of the Ready prompt in what Is obviously a Boot-up system status. When a computer program blows up, the computer actually stops. To find out what went wrong requires the skills essociated with the debug function, plus those of an experienced Assembly programmer.

Ample use of error-trapping procedures will assure the applications program will

"If the command returns to a zero," it means an error-free operation was performed since the last error.

always give a positive indicator of what problem has occurred. Unlike interpreter Besic, the MetaBesic compiled program will not stop program execution erbitrarily when e problem has been encountered. Instead, the error condition register is posted with the code number for the error; the errortrep register is checked to determine if an error-trap line number is active; if it is, the error exit tekes plece; if not, the operating system merely returns to the user's progrem after refusing to perform the requested function. The error code may be retrieved at any time by the command "A = ERR". If the command returns a zero, it means an error-free operation was performed since the last error. Every operating system function except ERR resets the error-trep register to zero before performing its requested func-

How the MetaBasic Compiler Works

Neerly every MeteBesic Compiler user will be initially interested in compiling already existing interpreter Besic programs, as opposed to writing new programs specifically for the compiled environment.

Accordingly, the Precompiler will be as important as the Compiler itself.

Except for certain definition functions, the first word in e MetaBasic command is always e command word. Thus, the principal job of the Precompiler is to review the interpreter Basic progrem to ensure every commend may be transleted into MetaBasic format, end to do so if possible. If not, en error diegnostic is inserted conspicuously into the output MetaBasic progrem file.

The Precompiler is a group of three programs. The first program catalogs all refer-

enced line numbers and makes certain all such lines ectually exist. The first line of the program is always defined as a referenced line number, because it eventually will be, even if the program in its original interpreter Basic form does not reference it. Since Assembly does not use line numbers, all referenced line numbers are converted into name tegs by inserting the letter L before the number. These eppear as new lines in the form "L1000 EQU \$", which is called an "equate" pseudo-operation command used by the assembler to identify a referenced address. From this point onward, the actual

FIXED ASSETS

Put your TRS-BO computer to work keeping track of all information related to your fixed assets and depreciation. This versatile system, developed by a CPA, will compute depreciation according to straight line, declining balance, and SYD methods and maintain the complete audit trail you need for financial and tax reporting, including fixed asset ledger and acquisition and disposal reports. You will be able to project depreciation for current end future years, use different methods for financial and tax reporting, switch from declining balance to straight line when advantageous, compute investment tax credit and additional first-year depreciation. Reports are available in both summarized and detailed formats, and can be organized by general ledger account, location, department, ADR class, and year of acquisition.

Currently available for the TRS-80 Model I with at least 32K and 2 disk drives, and for the Model III with at least 32K and 1 disk drive. Requires Disk Basic and a TRSDOS-compatible operating system.

TAB132

At last, here is the solution to LPRINT TAB problems with your TRS-80 Model I computer. Increase your programming productivity with this enhancement to Basic. Stop going through string manipulations and contortions trying to overcome the TAB(63) limitation. With TAB132, you will never again have to fret over tabbing past position 63 on your line printer. TAB132 will allow you to correctly tab to any print position up to 255 with the normal TAB() statement.

TAB132 is a machine language routine which occupies 100 bytes of memory, and will operate with either Level II or Disk Basic on the TRS-80 Model I. The TAB132 tape or disk includes modules for several different modes of operation. It can be loaded in the System mode or from DOS, can be loaded and run as a Basic program or merged into your Basic program and activated with a single GOSUB at the beginning of the program. System and DOS modules include a relocating loader to move TAB132 to anywhere in memory. Also supplied is a program which will patch the routine permanently into Disk Besic. Specify media when ordering.

TAB132 on tape . . . \$12.95 on disk . . . \$14.95

"Effective use of the Concur command is probably the most powerful component in Meta-Basic."

line number of a given line is of no importance.

Because the first line of the program is always the first line to be executed, the precomiler removes all non-executable lines of code (which would normally be ignored by the interpreter) and reinserts them above the first line. These include all dimension statements all data statements, and all declarations of names, both public in the present program and external in other programs. Immediately after the first line, the precompiler will insert all implied Open commands (screen, keyboard, printer), giving the default initialization values for those devices. A Print command will generate a run-time error if the printer is not an initialized ("opened") condition.

Concur

If the user wishes to break the present program into workable parts, or wants other program modules to be loaded into memory at the same time as the present program, he may insert "Concur" pseudo-commands as the first operations performed at the first line of the program. The commands permit naming up to six other program modules to be in memory concurrently with the present program. Concur is exactly like Chain except that control always returns to the user's program instead of being transferred to the newly loaded program module. Effective use of the Concur command is probably the most powerful component in Meta-Basic.

MetaBasic is space inefficient on the disk file: This design decision was made detiberately for simplicity and maximum user information. Throughout the MetaBasic precompilation and compilation process, a single ASCII-format sequential file and workfile are used for all stages of program output. Error messages are embedded directly into the erroneous line, and it is recommended the user make ample use of both screen LISTs and printed listings.

In addition to error diagnostic insertions, the precompiler formats the Basic program into the beginning of Assembly field formats. After the line number, the first field is the tag field, the second is the opcode, the third is the operand field and the fourth, if present, is the commant field. The precompiler always begins the opcode field in the same place, whether a tag has been used or not. This greatly enhances readability but is not required for correct precompiler or compiler operation. Field structure is completely variable and there is no need for blank spaces between the operand elements.

Finally, the precompiler expands the interpreter Basic program by as much as two times the original number of lines. This is caused by the insertion of tag equates and reprogramming. There are many Basic interpreter commands which simply do not exist in MetaBasic; for example, an If...Then statement which contains the logical OR or AND functions may cause the expansion of as many as one dozen lines of emulating logic. In another example, numeric literals, quoted string literals and functions (VAL, ASC, ABS, etc.) may not appear in any command except a move-data command (SETBCD and SETSTR).

So that these do not have to be reprogrammed by hand, the precompiler removes them from the original command line, equates them to a working location, and substitutes the working location name back into the original command line. During compilation, the program grows to at least four times its original number of lines as illustrated by the move-data commands in Fig. 2. While the resulting Assembly program is a traction of the size of its source counterpart, the source file can become huge. Some effective method of copying with large files must be provided.

The method is the Concur command, together with the source-level address linkage utility. Working with the MetaBasic source program tile, the program may be unceremoniously chopped into halves, thirds, quarters, etc., and established as stand-alone files (PROG made Into PROGA, PROGB, PROGC, PROGD, etc.). The resulting pieces of the original program are then run through the "external resolution generator" utility. Every data location and line name in each of the parts reterenced by any one of the other parts will be automatically named "Public" in the part and "External" to the other parts which reference it. The result is that all parts communicate among each other as easily as though they were still one program tile. The external reference generator may be run as often as needed, if changes are made.

The external reference generator utility also knows which program module is the first or main module. At the beginning of that module it will insert the Concur commands necessary to cause the Z-Monitor loader to load all subordinate modules as

soon as the main module has been loaded.

After the first program of the precompiler has generated all the line number reference tags, it is a good idea to look at the program file and determine whether it should be subdivided into two or more program files at this point. Generally, it the program file is longer than 8-10 granules or 20K disk space, subdivision is strongly recommended. It is not necessary to do so, however, and the user may elect to continue on to the second of the three precompilation programs.

But Is It Legel?

The second precompiler group program analyses all command syntax except for dimensions and input/output operations of all kinds. The general rule for syntax analysis is, if the interpreter Basic form is not legal under the interpreter, it will be flagged and abandoned; if, however, it is legal under the interpreter and legal under MetaBasic in an altered form, it will be automatically reprogrammed to save manual labor. If it is legal under the interpreter but illegal under MetaBasic in any form, it will be flagged and abandoned.

The thrust during second-stage precompilation is what is legal under the interpreter but illegal in any form under MetaBasic. MetaBasic requires only one command (or one command and a comment) per numbered line. Error-trapping, already mentioned above, is one reason for this; another is that the logic of multi-command lines invariably becomes intermixed with the interpretation of If...Then statements. If... Then statements not only do not exist in that form in MetaBasic, there are no consistent rules for their interpretation among the various versions of Basic.

The second restriction, which will annoy many interpreter Basic programmers, is against complex functions and multi-function commands. For example, the precompiler will correctly handle "A = A + B*(C-D)/2". In truth, the author was reluctant to take on the responsibility for interpretation of fluid logic in addition to that for creating error-free Assembly code. Another example

Meta6asic			ssembly	
1000	SETSTR A\$ = B\$	1000 ;SETSTR	A\$ = B\$	
		1010	CALL	SETSTR
		1020	DEFW	AS
		1030	OEFW	es
1040	SETBCD A = VAL(AS)	1040 ;SETBCD	A = VAL(AS)	
		1050	CALL	VAL
		1060	DEFW	Α
		1070	DEFW	A\$
		Fig. 2		

"A single test is madegreater-than for incrementing loops and less-than for decrementing loops."

of rejected logic, in complex functions, is "A\$ = STR\$(VAL(B\$)/ABS(D))".

The second state precompiler will not annoy the user with mere violations of form. For example, if the user tests an embedded literal (not allowed), the precompiler will remove the literal into a generated workspace (see Fig. 3). Because If...Then statements have no direct counterpart in MetaBasic but due to their program frequency and importance, there is no variation, including logical OR and AND, which the precompiler will not automatically handle correctly so long as the user does not embed complex functions and computations.

One final restriction is common to all compilers. For... Next... Step commands must occur in perfectly matched pairs; the command Next by itself (as opposed to a named variable, such as "NEXT X") is not permitted. There are no practical restrictions on the number of For... Next loops which may be nested inside one another.

For...Next loops are another form of instruction which does not exist either in MetaBasic or in Assembly and must there-

fore be amulated. The variables will be initialized, the first loop will be executed, and the first test-after-incrementation will take place. The default condition for testing is increment. Decrement will not take place unless the Step argument is a negative literal (the compiler cannot test a value which will be known only at run-time). A single test is made—greater-than for incrementing loops and less-than for decrementing loops.

The Third Program

The third program handles all physical commands, including DIM, Data, Read, PEEK, POKE, Set, Reset, Restore and all input/output commands including Input, Print, LPRINT, Get, Put, LINEINPUT and PRINT#. MetaBasic dimension statements

are structured closely to those of interpreter Basic; but their internal handling is very different. If the user has not explicitly dimensioned his data names, the precompiler does it for him with default values which must be checked for acceptability. Internal data is essentially handled as under the interpreter; it is formatted wherever it is encountered in the program, the precompiler ensuring that program logic jumps over the data areas. The address of each datum is entered into a table beginning with a table element pointer and ending with a table terminator word.

Both DIM and Data have interesting MetaBasic options. Since the program being precompiled may have been subdivided, and since deta variables should not be di-

Basic

1000 IF A\$ = "DATA" THEN 2000

MetaBasic

1000 SETSTR WK\$002 = "DATA" 1020 COMPSTR A\$ TO WK\$002

OMPSTH AS TO WK\$002

Fig. 3

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". . . MetaBasic or Z Monitor disk format is nothing like the TRSDOS disk format."

mensioned twice in one program, DIMs may be changed to External pseudo-operations by so indicating at the beginning of the job. Internal data, however, will be automatically set up in a new table within each program module. This presumes the programmer may wish to have program modules created for the sole purpose of organizing large volumes of data in kind of internalized indexed-sequential Read format, with the associated ability to restore to the beginning a part of the total date without having to restore it all the way back to the beginning of a possibly quite large table. When originally programming in MetaBasic, the programmer may designate which of 100 internal data tables a unit of data should be assigned to by appending the table number to the Data command, as in "DATA62 A,B,C,D," THIS ",E,1,2". This string of data would be assigned to table-neme "DATA62", even if it were the only data table in the progrem. The corresponding Read and Restore commands would be "READ 62" and "RESTORE 62".

PEEK and POKE function as in interpreter Basic; their values are decimal.

The Set end Reset commands are exactly as under interpreter Basic, but they will be replaced by the "Draw Dot" end "Draw Blank" commands, respectively, which are part of the command set for business graphics.

input/Output

MetaBasic recognizes five different stendard I/O devices for the TRS-80 Model I: screen, keyboard, line printer, disk drives and serial I/O port (communications). Each has its own particular command words which may not be intermixed at the Basic or MetaBasic level (see Fig. 4).

Clearly, the majority of these commands cannot be written under interpreter Basic, and illustrate the paucity of eveilable command words available to the Basic programmer given the range of peripheral equipment available to the TRS-80 Model I user today. It is important, however, that the user understand what will happen to the I/O commands in his interpreter Basic program when processed by the precompiler.

The Conversion

An easy way to remember the conversion is: display to the screen, input from the keyboard, strobe for a depressed key, prints to the line printer, and read and write from or to a disk file. PRINT@ commends generate a "CURSOR 1,p" command before printing. Unlike interpreter Basic, MetaBasic never adds an automatic carriage return at the end of the printed line. If the interpreter Basic line ends in a semi-colon, the precompiler will not generate the "SCROLL UP,1"

command for the screen and the "LINE UP,1" command for the line printer. In both cases, printing null (PRINT"" and LPRINT"") and Print or LPRINT command without an argument will result in the appropriate line advance command. Where repeated Print and LPRINT commands have been used sofely for vertical spacing, the single-advance commands which result may be consolidated into a single advance command with the number of lines desired as the argument, as in "LINE UP,6".

Sequential disk files are handled essentially the same as under interpreter Basic, except only one verieble may send or receive date with each command. Accordingly, the command "LINEINPUT#1,A\$,B\$.

C\$" would result in three separate "READ LF1,[...]" commands.

Random access files are handled somewhat differently. There is actually no such thing as random access mode under Meta-Basic. The Record I/O file format defines fixed-length records which may be written and read by sequential record number (beginning from one and continuing until end-of-file) In both sequential-access and random-access modes. There is no such thing as a Field statement, which is actually a clumsy adaptation from Cobol. To attempt to avoid manual reprogramming, the following conventions will be followed by the precompiler: The random-access file will be opened in both (read and write) ac-

evice/Mode	Command	Meaning
creen	SCROLL UP,n	Move lines up n linea
lisplay)	SCROLL DOWN,n	Move lines down n lines
	SCROLL SET,n	Protect first in lines from scroll
	CURSOR [ON] [OFF]	Gursor visibility
	CURSOR 1,p	Position cursor at line, position
	DISPLAY A\$	Print data on screen
Screen	SCALE v,h	Ratio screen addressas lo data
graphics)	PLOT v.h	Draw dot
	BLANK v,h	Draw non-dot
	DRAW LINE, v.h. v.h	Draw line from, to
	DRAW GOX,v,h,v,h	Draw rectangle within corners
	DRAW VBAR,w,v,h,v	Draw vertical bar of w-width
	DRAW HBAR,w,v,h,h	Draw horizontal bar of w-width
	FONT n,1,p	Change character size, lines, posns
	CHAR A\$,v,h	Print data on screen
Ceyboard	INPUT A\$	Get deta to a carriage-return
	STROBE A\$	Check if key was atruck
	ABORT AT nnnn	GOTO nnnn if GLEAR key struck during manual interrupt
rinter	PRINT A\$	Print line on line printer
	LINE UP,n	Advance n-lines
	LINE DOWN,n	Reverse n-linea
	LINE EMS,n	Advance horizontally nth-inch
	LINE LEAD n	Advance vertically nth-inch
	PROMPT [ON] [OFF]	Tell operator to change new page
	VMARGIN I,b	Set top/bottom page margins
	HMARGIN I.r	Set left/right page margins
	FONTSET [M] [A],A\$	Manual/auto font name changa
	PAGEn	Skip ri-heada-ol-form
	HEADER AS	Set rapeating page header message
	FDOTER AS	Set repeating page footer message
	TABSET n.p	Set tabatop n et position p
	TABn	Skip to tabstop n
Disk	REAO LEGAS	Read data from logical file n
eriable)	WRITE LFn.AS	Write data to logical file n
isk	READ FILE LFn,AS,	Read data from record r in logical
ixed)	REC ≈ r	Fila number n
	WRITE FILE LFn,A\$,	Write data to record r in logical
	REC = r	file number n
erial I/O	BAUD nnnn	Set baud rate
	WORDLEN n	Set bits/word
	STOPEIT n	Set number of stop bits
	PARITY AS	Set parity odd, even, none
	FBYTE A\$	Set autometic first byte
	LEYTE AS	Set automatic leat byte
	XRACK	Send request for ecknowledgement
	XACK	Transmit acknowledgement
	XNACK	
	XMIT AS	Transmit negativa acknowledgement Transmit data
	RCV AS	Receive date
	TIMEOUT A	
	TIMEOUTA	Set seconds to weit for answer
		Fig. 4

cess modes. The Get command will read data into a precompiler-generated data location called "RA\$n", where n is the logical file number assigned to the randomaccess file. The variable names in the Field command will be placed in a special lookup table. Whenever one of the Fletded variable names is referenced in a date move, the name will be changed a MID\$ command which references RA\$n by the subfield beginning number and length. Whenever an LSET command is encountered, the reverse will occur, and a Put command will again reference RA\$n. The data name "DUMMY\$" will be ignored in a Field command, but the position counters will be incremented. The precompiler will not attempt to handle more than two random access files per program segment.

It is equally important to note that the MetaBasic or ZMonitor disk format is nothing like the TRSDOS disk format. The directory is on track zero, not 17. Files have both names and numbers. Protect status is prevention against inadvertant destruction, not a futile exercise in pseudo-secrecy. A file's protect status is turned off by merely

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entering "PROTECT OFF". Most importantly, there are 64 different physical formats from which the user may choose in an effort to optimize space against speed. A disk record may contain as many as 2048 bytes or as few as 16. The Format command will optimize the physical placement of the records on a besis of so-many-per-track.

Whenever a sequential (variable length) file is declared, the disk surface remains formatted at ten sectors of 256 bytes per track. But when a record I/O (fixed-length) file is declared, the declaration must include the record length (RECL=nnn). Based upon this information, the named file's tracks are reformatted to physical records of the indicated length. Thereafter it is no longer necessary to block-up data records before writing to the file, nor to block-down to individual records after reading from the file. The numbered record is named and becomes available at record speeds.

This altered approach to disk I/O Is not new; it is adapted from standard IBM disk I/O procedures. Accordingly, it makes possible a new high-speed lookup procedure called "indexed-sequential" organization.

This altered approach to disk organization also makes possible genuine high-speed disk-based sorting. The data itself is never sorted. Keyfiles are established and sorted, then the input files are rewritten to output file in an altered sequence based on the new order of the keys.

The output from the third stage of precompilation is supposed to be an error-free, pure MetaBasic source file. Since the file might have been written by hand, it may also be modified manually, including the insertion of the user's own machine code subroutines. MetaBasic source files may also be passed through the Assembly macroprocessor for this purpose. Every line of MeteBasic code is preceded by a colon at the first character position after the blank space which terminates the tine number. After compilation, this will be changed into a semi-colon, which is the assembler's comment symbol. Assembly commands inserted by the user should not be preceded by a colon or a semicolon. ■

Next month: More on the MetaBasic Compiler.

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With the help of Zen, build your own printer interface.

Hard and Soft Printware

I. R. Sinclair 89 Alexandra Road Sible Hedingham Halstead, Essex England C09 3NP

by tha time I had owned my TRS-80 for a faw months, I had resolved that the first priority would have to be a printer. When your programs are short enough to list on the screen without scrolling, a printar seems an unimaginable luxury. But one of the joys of the TRS-80 lias in writing longer and longer programs using all the power of that big Basic. As a result, by the start of 1980, I was suffering severaly from printout starvation, end only the use of a borrowed Teletype 33 kapt ma going.

About the same time, printer manufacturers must have noticed this problem, because there was a sudden flush of printers at \$700 and lass. Better still, they weren't thermel or electrostatic but real herd copy paper-markers. I suspect there was, in fact, only one mechanism with many manufacturars fitting alectronics to it, but the result was certainly good for me. After some phone calls and a drive of a few hundred milas, I had a smeller bank balanca and the feeling that I was, at last, winning the hard copy battle.

The Lowdown

I was right, but there was a long way to go. If you still want to jump on the hard copy bandwagon, this article will give you the complete lowdown of both herdware end software that will allow you to get into hard copy for only a few dottars more than the prica of the printer.

It doesn't metter what type of printer you use, providing it has an RS232 Interface built in. As far as I know, all the modern el cheapo printers use this type of interface, which lets us get away with simple attach-

ment to the TRS-80 cassette port. The baud rate (the speed at which bits can be set from the computer to the printer) can be altered by setting the position of wire links inside the printer, and for this type of use the rate should be set at 300 baud.

Don't be tempted to set the rate higher in hopes of faster printing—the simple interface I am going to describe is reliable at 300 baud, but not at higher speeds. For higher speeds, a connection is needed from the printer to an input on the expansion interface connector of the TRS-80 so the printer can stop the computer when it has sent more characters than the printer can cope with. This type of connection is called a handshake, and my simple interface does not include this type.

Designing From Scretch

I had seen a elmple interfece described in a local user's group neweletter, but I doubted it would really work. I was right, so I set about designing my own interface from scratch.

The first thing I had to know was how large the signal from the cassette port would be. A cassette recorder does not need a large signal input, and too great a signal can cause distortion which leads to loading difficulties when the tepes ere replayed. I bought only the keyboard unit of the TRS-80, and my cassette recorder is a sensitive one, so I had to cut down the signal atrength by modifying the cassette output circuits. I used a voltmeter to measure the signal strength.

Step one was to get an output. Fortunately, on the TRS-80, it's not necessary to print a program to find out what happens at the cassatte port. A simple program line was typed in and run:

10 OUT255,0:FOR N = 1T01500:NEXT:OUT255,1:FORN = 1T01500:NEXT:GOT010

This produced a voltage reading on the meter (attached to the cessette output socket) which varied from 0.46V to 0.48V and back again as the program ran. This is not a very large voltage swing for the input to an interface, though it's big enough for a cassette recorder. I started looking for ways to increase it without any further alterations to the TRS-80 itself. A quick look at the output circuitry showed that this could be done by altering the program to:

10 OUT255,2:FORN = 1TO1500:NEXT:OUT255,1:FORN = 1 TO1500:NEXT:GOTO10

Simply by using a two in place of a one, the voltage awing became zero to 0.86 V, a lot greater end a much easier amount to deal with. I incorporated it into software for the printer.

The next step was to build the interface, an amplifier which would taka the voltage swing of 0 to 0.86 volts at the cassette port and trensform it to a voltage which (approximately) varied between -9V and +9V. These serial printers are tolerant animals, they don't appear to object if the pulses eren't strictly RS-232 standards. I was correct in assuming that a very simple amplifier would be good enough. Ten minutes on a solderless breadboard got me into hard copy, and a few hours work the next day (yes, I felt I had to make listings of all my programs in case it stopped working) resulted in a more polished version.

The interface

The interface consists of a 741 operational amplifier IC, which draws its power from a rectifier bridge circuit which, in turn, is powered from tha TRS-80 power pack. It uses only a small amount of power and constitutes no hazard to the TRS-80 supply. The unit is built into a small plastic box, and connects between the TRS-80 and its power

"Building a low-cost interface may give you a glow of achievement."

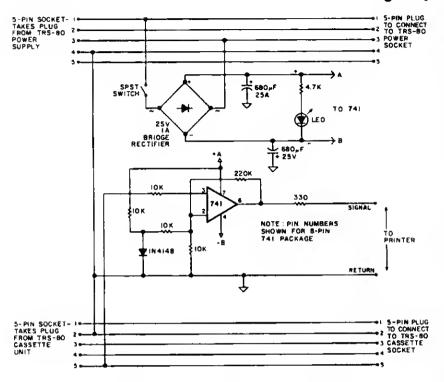


Fig. 1. This is the circuit for the interface unit. All resistors are 1/4 W rating. The switch is optional, but if there is no online switch on your printer, it will prevent the printer from printing rubbish during a CSAVE.

and cessette plugs. The power plug from the TRS-80 supply goes into the interface, and the corresponding plug from the interface plugs into the TRS-80 power socket. The cassette lead is treated in the same way, so the interface can pick up power from the power cable, and signals from the cassette cable, but does not interfere with the operation of either. (There is no need to unplug the cassette unit, for exemple, when the printer is being used.)

The specific layout is not criticel, and the circuit can be built in any way which you ere accustomed to. I used Veroboard, but any type of matrix board which is designed for ICs le suiteble. Meke sure that the two smoothing electrolytic capacitors are correctly wired, because if the voltages are positioned wrong they can overheat and burst. The most tedious part of the whole effort is soldering the five-pin DIN plugs to fit into the TRS-80. Make sure before you start that the plugs will actually fit, because some plugs have elaborate covers which may prevent them from being correctly inserted.

For the benefit of you hardware pros, the circuit is a non-inverting amplifier. The signal from the cassette port is teken from pin 5 of the cassette socket through a 10K resistor to the + input on pin 3 of the 741. The — input on pin 2 is connected to a blea network, consisting of the diode end arrey of

10K resistors, and also to the feedback resistor of 220K. This feedback resistor elso sets the amount of amplification. The output signal is taken from pin 6 of the 741 IC through a 330 ohm resistor. Power supplies of +9V and -9V ere needed to operate the 741, and these supplies are obtained from the TRS-80 by connecting pins 1 end 3 of the power socket to e bridge rectifier. The output from the rectifier consists of the +9V and -9V lines, emoothed by 500µF capacitors. The cable to the printer does not need to use the expensive 25-pin Cennon-type pluga which so often appear on printer connections (using only two pins, it seems pointless to use a 25-pin plug). On my unit, I simply used a length of power cable, permanently attached at the interface. If you like pluga and sockets, a miniature two-pin unit is as good as any. The connection to the printer consists of the RS232 signal line and earth return only.

Check the circuit carefully, particularly the power supply section, because a fault here could damage the TRS-80 power supply. Testing will now have to welt until you have assembled the software!

The Software

Building a low-cost interface mey give you a glow of achievement, but that will quickly dissipate if you have to spend \$30

on the software to make it all work. Many serial printer programs exist, but none of them suited my needs, and so I developed my own, slowly and painfully. I wanted more than a straightforward routine, because the reason for buying a printer was so I could have listings of programs at various stages of development. (I hate keeping long rolls of paper, and I wanted a program which would list Into neet pages of the same length as Radio Shack uses, 66 lines per page.)

Looking at a sample sheet which my printer had listed (when I bought it), I saw that the left mergin was very small, too small for my filing methods, so another requirement for the routine was a left margin, preferably one which could be altered. The most important point, at first, was that the program should be fully relocatable, with no jumps to absolute addresses within the program. This way, I could use the same program at any address, or POKE it from e Basic program anywhere in memory, or as a string. I modified this requirement later!

My program specifications grew and grew. Having 66 lines per page implied that there would be a line counter, along with a reset method for the counter to ensure I could start a listing with the counter loaded to its full 68 lines. I wanted to use a command word for this rather than a POKE to memory. In addition, I wanted a keybounce delay (my '80 is an old one), and also some method of putting in a longer delay when I wented It.

Fortunately, when it came time to write the progrem, I had the assistance of one of the best pieces of softwere I know of. It's an assembler-editor-debugger package for all Z-80 based machines, and its name is Zen. I don't know if Zen is available in the States; If It's not, I can pass on the name of the source in England.

Zen is simple to use-which means that you drop the menuel quickly and concentrate on using it rather then trying to find out how to. As an essembler, it's versatile because entry is in free-format-you don't have to enter spaces of e set size, or even be careful ebout the number of letters in a name. Editing is very simple, just enter a new line, zep an old line or insert a new line. Assembler programs can even be combined from separate tapes, because the Zen line numbers are generated internally instead of being recorded on to the tape, as Radio Shack does. It also has e monitor section which lets you read in machine-code tapes, examine contents of memory, change codes, copy machine-code tapes, copy code from one set of memory locations to another, and even load code into memory es it is assembled by the assembler. This eliminates the tedious business of creating a tape and then reading it back in again. The

"The only problem is that there is no disassembler..."

only problem is that there is no matching disassamblar, but I am working on a program for reading in tapes produced by the Instant Software disassamblar and producing from them a tape written to Zen standards.

The Zen listing is shown in Program Listing 1. There are no notes on the assembler listing itself, because I never have anough room on an assembler program for all the notes I want to make, and tapes take long enough to read without hav-

Ing all the axtra characters loaded onto them. As I davelop a program I keap all the original specifications. The amendment notes and listings result in my own home-made manual. This tells me more than a few notes on the program itself, and

	NT ROUTINE WITH LHS MARGIN INES/PAGE AND 72 CH/LINE ORG 7F11H N: EQU 4029H EQU 4023H PUSH HL LD HL*LPRT LD (4026H)*HL LD HL*CHREN LD (4029H)*HL LD HL*CHREN LD (4029H)*HL LD HL*TOPPAG LD (417DH)*HL LD HL,*TOPPAG LD (4183H)*HL POF HL JF 0872H DI LD A*C PUSH AF PUSH AF PUSH BE PUSH IY CALL 6033H POP IY FOP BE POP AF (* CF 0DH JR 2*RELGAB CF 20H RET C JR 3*TART AD: FUSH HL FUSH AF LD HL*CHREN LD A*CCRKSLN LD HL*CHREN LD A*H LD HL*CHREN LD HL*CH	77 7EG4 (157227)	CALL DL7
1 7LPRI	NT ROUTINE WITH LHS MARGIN	73 7F94 CD797F 24 7F97 16E9 75 7F99 2102FC 76 7F99 CD2102 77 7F9F CD797F 78 7F42 F1 79 7F43 F1 80 7F44 FE01 31 7F46 CD21 82 7F40 210D7F TEST1:	TINT COUNT
2 766 L	INES/PAGE AND 72 CH/LINE	74 7177 IULY	1 h HL-SECONU
3	QRG ZF11H	75 7577 E1015C	CALL GOOTH
4 CHR3Li	N: EGU 4029H	70 /19C UDITE	CALL DELTA
5 LNPGE	: EQU 4023H	77 7F9F UD/97F	CALL DET
å 7F11 E5	PUSH HL	78 7FA2 F1 0013:	FUI AF
7 7F12 21347F	LD HLVLFRT	79 7FA3 F1	PUP AF
8 7F15 2226 40	LD (4026H)+HL	80 ZFA4 FEØN	CP ØDH
9 7F13 21F27F	LD HL-KBFIX	31 7FA6 2022	JR NZ+TEBIL
10 7F18 221E48	LEI (401EH)+HL	82 7FAS 21DDZF TEST1:	
11 7FIE CADEZE	LD HL; CHRLN)	93 7FAB AF 84 7FAC BA	XOR: A
12 7F21 222 940	LID (4029H)+HL	04 7FAC B6	OR (HL)
13 7F24 21DF7F	LD HLYTOPPAG	85 7FAD 2612	JR Z.BLNK
14 7027 227041	LD (417DH)+HL	86 7FAF 35	DEC (ML)
15 7F2A 21E77F	LD HL, DELA/	97 7FB0 3C0D	LD AyODH
16 CF DI CD8341	LI: (4183H), HL	88 7FB2 18B5	JR ACAIN
17 7F30 EL	POF HL	84 7FAC B6 85 7FAB 0812 86 7FAF 35 97 7FB0 3E00 86 7FB2 18B5 87 7FB4 C1 0UT4: 90 7FB5 21BE7F 91 7FB8 281D	PGF BC
18 FF31 C37200	JF: 0072H	90 7FBS D1BEZE	LD HL, CHRLN
19 JF34 F3 LFRT:	DI	91 7FB3 35	DEC (HL)
20 7035 79	LD A.C	72 7FB9 201D	JR NZ,OUTS
21 7F35 F5	PUSH AF	93 7F6B E1	POF HL
22 7F37 D5	PUSH DE	94 7FBC F1	POF AF
23 7F38 FDES	PUSH IY	95 7FBD 3E0D	LD A. ØDH
24 7F3A CD3300	CALL 0033H	71 ,FB0 2010 93 7FB0 E1 94 7FBC F1 95 7FBD 3E0D 90 7FBF 1089	JR RELOAD
35 7F3D FDEI	POP IY	97 7FC1 21087/ BLNK:	
2a 7F3F IO	FOF DE	98 7FC4 3403	LD (HE)+M3H
27 7F 40 F1	POP AF	98 7FC4 3403 99 7FC3 3EC0 100 7FC5 189F	LD AyCOH
28 7F41 FEØD ENDLN	(: CF ODH	106 7FCS 189F	JR AGAIN
29 7F43 2895	JR Z≠KELOAD	101 ZFCA BADEZF TESTO:	LD A,(LHSFCE)
30 7F45 FC20	CF 20H	102 7FCD 87	QR A
31 7F47 D8	RET C	103 /FCE 18E+	JR Z⊧0UT4
32 7F48 181C	JR START	104 7FD0 3D	DEC A
33 7F4A ES RELDA	AD: FUSH HL	105 JFD1 32DBJF	LD (LHSFCE)+A
34 784E F5	FUSH AF	10c 7FI/4 3E20	LI: A.20H
35 7F4C 21DE7F	LD HL, CHELN	107 7FD6 1891	JR AGAIN
35 7E4F 3A2940	LIF ARK CHRSLNO	108 7FD8 E1 OUTS:	POF HL
37 7F52 77	LD (HL)+A	109 7FD9 F1	POF AF
38 7F53 21DC7F	LD HEFENONT	110 7FDA C9	RET
39 7FS6 35	DEC (HL)	111 JFUL 03 LHSPCE	: DB 03H
40 7757 2000	JR NZ+RUN	112 7FDG 42 LNCNT:	DB 42H
41 7F59 2A2840	LD HL+(LNFGE)	113 7FDD 00 ENDPAC	: DB 0 0H
41 7FSC 22DC7F	LI (LNCNT),HL	114 7FDE 48 CHRLN:	DE 48H
43 7F5F 21DD7F	LD HE, ENDFAC	115 /FDF ES TOPPAGE	: PUSH HL
44 2F62 3606	LD (HL)+96H	116 7FE0 C1DC7F	LD HL+ENCHT
45 7F34 F1 RUN:	POP AF	117 7FE3 3642	LD (HL)+42H
46 7F65 E1	POF HL	118 7FE5 E1	POP HL
47 7F46 F5 STAR*	T: PUSH AF	101 /FGA 3ADE/F TESTC: 102 /FGB 3ADE/F TESTC: 103 /FGE 208+ 104 /FD0 3D 105 /FD1 3CDB/F 106 /FFD4 3E20 107 /FD4 1891 108 /FD9 E1 109 /FD9 E1 110 /FD0 C9 111 /FD1 03 LHSPGE 112 /FFDA 42 LNGNT: 113 /FDD 00 ENDPAC 114 /FDE 48 CHRLN: 115 /FDE 48 CHRLN: 115 /FDE 5 TOPPAG 114 /FEB 3A42 116 /FEB 51 117 /FES 3442 118 /FES E1 119 /FES 69 120 /FEZ F5 DELAY:	RET
48 7F 67 E5	PUSH ML	120 7FE7 F5 DELAY:	PUSH AF
49 7F48 C5	PUSH BC	121 7FE8 3AF67F	LD AK(NBFIX+4)
50 7F49 0409 AGAIN	N: LD B:09H	101 7FE8 3AF67F 101 7FE8 3AF67F 100 7FEB 5E1 6 103 7FEB 3CF67F 104 7FF 0 F1 105 7FF1 09	XQR: 10H
51 7F&B 37	SCF	123 7FEB 32F67F	LD (RBFIX+4),A
52 7F4C F5	FUSH AF	124 7FFØ F1	FOP AF
53 7F6D F5	PUSH AF	125 7FF1 C9	RET
54 7F6E 2101FC	LI HL, ØFC@1H	126	QRG ZEE2H
55 7F71 CDC10C	CALL 0221H	127 7FF2 F5 KBFIX:	PUSH AF
54 7F74 CD797F	DALL DLY	127 7FF2 F5 KBFIX: 120 7FF3 C5 129 7FF4 012000	FUSH 8C
57 7F77 1809	JR ROUND	129 7FF4 012080	FD RC*0909H
58 7079 21DE 88 DLY:	Lb HL+aabEH	130 7FF7 CD4080	CHET RECOLL
59 7F7C IB DLY1	: DEC HL	131 7FFA C1	POP BC
60 7F7D 7C	LD A.H	132 7FFB F1	POF AF
61 7F7E B5	OR L	133 FFFC C35004	JF 0458H
62 7F7F 20FB	JR: NZ,DLY1	134	END
63 7F81 C9	RET		
64 7F82 F1 ROUNI			
45 7F83 1F	RRA		
oo 7F64 F5	FUSH AF	AGAIN 7F69 BLNK 7FC1	CHRSLN 4029 CHRLN 7FDE
67 7F85 3005	JR NC+OUT1		DELAY ZEEZ ENDLN ZE41
48 7F87 2102FC	FR HF @LC@SH		ENFIGE 4828 LFRT 7F34
69 7FØA 1885	JR OUT2		OUT1 7F80 OUT2 7F91
70 7F8C C600 OUT1:			OUTS 7FD8 RELOAD 7F4A
71 7F8E 2101FC	LD HL-OFC01H		START 7F66 TEST1 7FA8
72 7F91 QD2102 OUT2:		TEST2 FFC4 TOFFAC FFDF	
) 	as the exercise represented

Program Listing 1. This is the assembler listing. If desired, the object code can be typed in using T-Bug, or the program reassembled using EDTASM. For complete relocatability, the DLY subroutine and the storage addresses should be located in low RAM, such as 405CH to 407FH (which is used only during the switchon sequence).

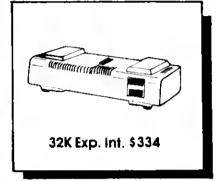
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"This tells me more than a few notes on the program itself, and doesn't use memory."

doesn't use memory. The program is arranged to give a baud rate of 300 for the reasons described earlier, but for enyone who uses 110 baud machines, one single alteration will give the lower rate.

The program has its origin at 7F11H, 32529D, end two of the printer control block addresses are used for storage, and another two bytes for the address of the new routine. Location 4028H(16524D) is used to store the number of lines per page. This is the number which is placed in this address when the TRS-80 is switched on, so no addition has to be made here. Location 4029H is used in this program to store the number of characters per line, and POKEing a new value into this address will alter the number of characters per line which your printer will deliver.

Four addresses in the program space itself are used also for storage, and these can be POKEd to change the quantities such as the left margin space and the gap between pages. As set up, the program prints 72 characters per line, 66 lines per page, four spaces on the left margin, and six blank lines between pages. A complete description of the program follows so anyone who wants to build on it for his own purposes can do so.

The first section of the program from 7F11H to 7F2FH loads up the RAM locations. Address 4026, with 4027, contains the address of the printer routine. When the TRS-80 is switched on, the operating system loads the address @58DH into these locations, which is the start of the ROM routing for a parallel printer. Our print routine starts at 7F34H, so that this is the address which must be loaded to these locations. This way, we can use the commands LLIST and LPRINT rather than having to use new command words. There is a similar readdressing at 40 1EH, 40 1FH. These addresses hold the address of the screen-print routine, normally 0458H, now directed to 7FF2H. This lets me put a delay into the screenprint routine, and serves two very useful purposes. One is that it debounces my keyboard, and the other is that it allows me to incorporate a slow-listing facility. The number of characters per line is loaded into 4029H, no load is done into 4028H because the regular 66 lines per page suits me. If you want a different number, add a couple of steps to accomplish this.

When a disk system is not in use several commands such as Field, Get, Put and about 25 others will return with L3 Error if you use them in Basic. According to the manual, this is because they are disk commands which work only when a disk operating system is loaded. In fact, each of these commands causes the operating system to look in RAM for the address of a routine,

and if you put in your own routine, and POKE its address to the correct place, you can make use of any of these commands.

In this program, I have used Field to reset the lines-per-page count, so the printer will print a full 66 lines before it creates the six blank lines at the end of a page. The address of a page-reset routine is loaded into 417DH, the reference address for the Field command. Similarly, I have used the command Put to change the delay time by loading the address of a delay-change routine into 4183H, the address for the Put command. By typing Put and entering from Basic the TRS-80 screen-print rate is slowed so the listing can be watched on the screen. This, combined with the TRON command, is a considerable aid to debugging a Basic program, because with these two I can watch a program execute in slow motion.

Typing Put for a second time and entering takes the additional delay out again. end screen operations proceed normally. This delay can also be placed in the keyboard routine, but there are advantages to using the screen routine. One is that the delay acts only when the screen is accessed, as it always is when a character is being entered from the keyboard. A delay in the keyboard routine, unless it is a rather complicated delay program like the Radio Shack KBFIX, slows down all program operations because the keyboard is scanned continually as a program progresses. This, of course, is why the Break key can be used. If you disable the keyboard you lose all control over a program.

The loading section ends with a jump back to Basic at 0072H, and the printer routine itself starts at 7F34H. The DI command is used so the routine cannot be interrupted in mid-character by the Break or any other key. The printer routines of the TRS-80 place the character to be printed in the C register of the Z80, so the next step is to transfer this to the accumulator so we can operate on it. The section of the program from 7F36H to 7F40H saves the registers and calls the screen-print routine, and whatever is sent to the serial printer is also echoed onto the screen. This is a useful teature because most dot-matrix printers conceal what they are printing until saveral linefeeds have taken place. If you want to be able to cut this feature in and out, use one of the disk control words to POKE 00 into locations 7F3AH and 7F3BH, and another to POKE back the bytes which are shown in these locations.

At ENDLN the byte in the accumulator is checked to see if it is a carriage return (QDH), in which case the program branches to reload to reset the characters-per-line count and to decrement the number-of-lines

count in location LNCNT. If at ENDLN, the byte in the accumulator is not a carriage return and is less than the space byte (20H), the program returns to ROM for the next character, because the control characters other than carriage return are not used in the program (the dot-matrix printers can be set to line-feed on carriage return, so the additional complication of a line-feed is not needed). For any other character, the program then jumps to Start.

At Start, the registers are saved on the stack, and register B is loaded with a bit count of nine (one byte plus a space). A mark bit is sent out (my printer interprets a mark as a 0 and a space as 1) by loading FC01 to the HL pair, and calling the TRS-80 subroutine at 0221H. Working on the results of the cassette port output voltage mentioned earlier, the mark byte is 01 and the space 10. To establish the correct baud rate, a delay must follow, and this is achieved in the subroutine DLY. The byte 00DEH, which is loaded into HL at the start of this subroutine, determines the baud rate. So if you want 110 baud, a larger number must be loaded here—try 0267H.

At the label Round, the bits which make up the character are sent out one by one. The RRA command shifts the contents of the accumulator one place to the right, so the lowest-order bit lands in the carry position. If the bit in the carry position is 0, C is reset and the program jumps to OUT1 to send out a mark bit. If the bit in the carry position is a 1 then HL is loaded with FC02H, the space bit, and this causes the OUT2 routine to send out a space. Each of these routines are followed by the DLY subroutine to keep the baud rate correct. Yet, at 300 baud the timing does not have to be exact. The DJNZ command at 7F97H keeps the rotate and output routine going until the B-register has been decremented to zero in the usual action of the DJNZ command. A final delay follows, and the program jumps to OUT3, which is the end of the part of the routine that outputs the character to the printer.

At OUT3 the AF register is POPped to recover the original unrotated byte and this is compared with the carriage return byte, 0DH. If the byte which has just been sent to the printer was QD, then the program skips to Test2 otherwise at Test1, the byte from ENDPAG Is loaded in which clears the accumulator. Now if the lines-per-page count reached zero earlier in the program (at Reload), there will be a six in ENDPAG giving the OR (HL) step a positive result. The program will continue by decrementing ENDPAG by loading a carriage return character into the accumulator and jumping back to output this to the printer. This will continue each time this place is reached un-

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END

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"My printer chatters away happily, and never has missed a character."

til the ENDPAG location is zero.

If the lines/pages count had not reached zero, the OR (HL) step gives a zero answer, and the program skips to location BLNK where LHSPCE is loaded in with the number three. The accumulator is loaded with the ASCII character 20H, and the printing routine is repeated, sending a space to the printer.

When the character in the accumulator was not a carriage return (and this includes the spece which is loaded at BLNK). Test2 is used. This checks the byte in LHSPCE to see it more spaces need to be output to the printer, otherwise e retest is sounded by a jump to OUT4. At OUT4, the number of characters per line is decremented (note that the blank spaces at the left side are not counted) and if the count has reached zero, the accumulator is loaded with a carriage return and recycled to the printer. If the byte is not at the end of a line, the next stage in the countdown is OUT5, where the registers are restored to the original values, and the routine returns for the next character.

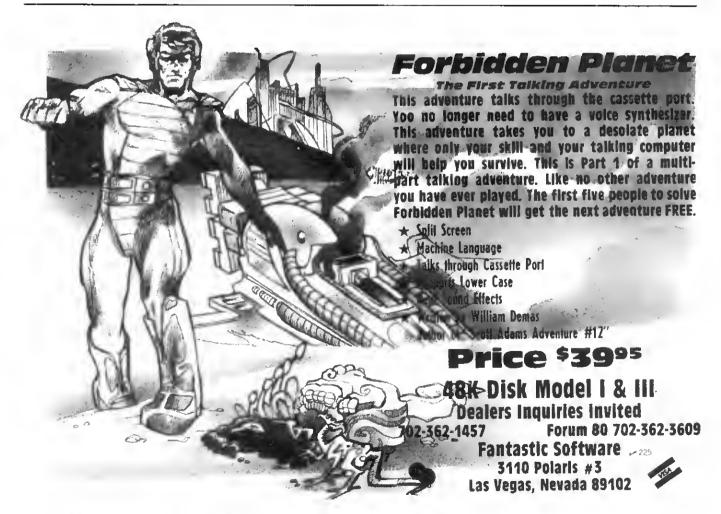
The rether odd jump sequences in this program so far allow it to be relocatable.

The bytes from 7FDBH to 7FDEH are storage bytes for the left-space, lines per page, end-of-page spaces, and characters per line respectively. These are fixed addresses which also make the program not completely relocatable, but there is no reason (apart from convenience) for having them in the high memory portion of the program. For example, they can be loaded into the top end of the cassette buffer memory or into disused disk command RAM; either way would make this part relocatable. At TOPPAG, e short routine restores the number of lines per page which is called by the Field command.

Similarly, at 7FE7H, another short routine calls a delay change routine, by taking the byte from 7FF6H, and X-ORing it with 10H. If the delay byte was the 00 set at the start of the program it is changed to 10 by this action. But if the byte was 10H, it is changed back to 00 by XOR. This routine is called by the Put command, and like the TOPPAG routine, it uses absolute addresses. This routine, like the TOPPAG, can be invoked from a running Basic program so screen scrolling cen be controlled from within the

program itself. Finally at 7FF2H, the video delay consists of saving registers, loading the BC pair with the delay bytes, calling the TRS-80 delay routine at 0060H, restoring registers, and then jumping to the screen routine in ROM at 0458H.

Now how did it live up to specification? It was not as easy to relocate as I had wanted, but that can be sorted out if needed. I had not realized at the stert how easy it would be to reassemble at different addresses. thanks to the Zen assembler. In any case, tull relocatability is not difficult to achieve. either by using low RAM memory for all fixed locations, or by loading registers through immediate loading. The real snag is the delay subroutine. This can be located in low RAM, or simply divided so there is a delay routine in each position where it is needed. However, I have no need for tull relocatability, and the program performs very well indeed. My listings now have left margins, so they can be punched for filing, and they cut neatly into page. My printer chatters away happily, and has never missed a character. What more could I ask?■





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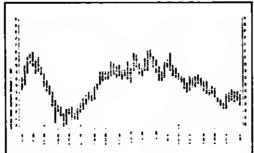
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STOCKCHART - I

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Add a synthetic keyboard to your TRS-80.

Auto-Key

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ver naed to input a complex mathematical expression during a Basic program run? How would you like to load machine-language files during exacution without disturbing the video display or variables?

Auto-kay adds a synthatic kayboard to your TRS-80. By synthetic, I mean a utility that uses a string of characters in place of the normal kayboard input routine.

Auto-kay is fast and aasy to usa; just define a string in Basic and execute a USR command. You can enter any character that can be entered from the keyboard, plus Basic Internal codes. For example, 185 is the code for CLOAD. If you enter CHR\$(185) into your string, Auto-key interprets it as CLOAD.

Further, Auto-kay savas 2.5K bytes of disk space over my pravious mathod of auto power up.

Compatibility is no problem. You can use Auto-key with Model I 4K Level II through 48K disk systems. I have not had the opportunity to use Auto-key with a Model III, but I foresee no problems.

How Auto-key Works

Auto-kay recognizes threa control codes. Control code 1

Auto-kay's Assambly coda is shown in Program Listing 1. Linaa 170-220 procass tha USR parameter to point to the string location. This allows you to use a simple command: X=USRO (VARPTR(A\$)), where A\$ contains tha target string to be procassed. The VARPTR function raturns the string pointar, not the string addrass. Lina 230 is

as a kay debounce routine, that may be active before Auto-key is run will be restored as well. These original drivers ere also linked to Auto-key.

Lines 290-330 load Auto-kay's address into tha video and kayboard Device Control Blocks (DCB), and raturn to the calling program. Auto-key is now initialized and ready for execution.

Linas 390-410 chack for the up arrow key and terminate Auto-key if it is pressed.

Linas 420-440 check to sea if the cursor is on. If it is not on Auto-kay exits via the normal keyboard driver, allowing IN-KEY\$ to ramain functional.

Linas 450-480 bump tha string pointer and load register A with the next character to be passed on.

Linas 490-540 tast for control code 1, the code to turn off the video. If a 1 is found, the video off driver is loaded into the video DCB; register A is cleared; and a raturn sands you back to the calier.

Linax 550-620 chack for a 3, the code for the and of the target string. If a 3 is found, all the original drivers are restored into their DCBs and Auto-key is

"How would you like to load machine-language files during execution without disturbing the video display or variables?"

disables the video driver. This allows you to work without disturbing the video display. Auto-key is initialized with the video driver disabled.

Control code 2 anablas tha normal vidao driver.

Control code 3 terminates Auto-kay and restores all drivars to their original condition. the Assembly Language entry point and loads register HL with your target atring address and Calls MACHMC, Line 240 saves the string address to be accessed later.

Linaa 250-280 sava tha vidao and keyboard driver addresses so they can be rastored. This anaurae that other drivers, such

242 • 80 Microcomputing, October 1981

untinked.

Lines 630-680 test for a 2, the code for video on. If a 2 is not found the character is assumed to be valid and is returned to the keyboard caller. If a 2 is found, the original video driver address is restored to its DCB.

Lines 720-780 are the video off routine. They check for a 14 (cursor on) or a 15 (cursor off). By replacing all other codes with a zero, this turns the video driver off. Lines 780 and 790 store the original driver addresses and serve as links for Auto-key.

One idea I would like to pass on is my use of jump (JP) vectors. If you look at RAM starting at 4000H, you will see a series of JP instructions. This allows various routine codes to be altered or updated. Since a change also changes the entry point for a given routine, any other routine which calls it would have to alter its call instruction. You need only change the jump vector to match the new entry point and everything goes just tine.

I use this concept a little ditferently. My jump vectors start in high memory and work down. Thus, I can move a routine or change it and all I need to do is change the jump vector to maintain compatibility with my many programs that access that particular routine.

Alterations and Enhancements

As written, Auto-key is not relocatable, but you could change that with a much longer routine. Enter the source code into your assembler and change the origin statement in line 110 to match your memory size or requirements. The 119 bytes of code for Auto-key can be contained in Basic data statements and POKEd into memory. Program Listing 2 uses this technique.

A program called Progdata (see 80 Microcomputing, May 1960, page 126) will make the task of defining these data statements much easier. Also you can add the code for Autokey to an existing machine-code program allowing easier loading and using less storage space.

Additional functions can be added to Auto-key by testing for another control code. For example, a CP 04 could be used to access a machine language routine. The code 04 would be followed by two bytes containing the entry point to the particular routine. By loading register HL with these two bytes and executing a JP (HL) instruction, you could have a vectored USR command. This

would be very useful in Level II

Basic which has only one USR

command. Don't forget to clear register A upon return. I'll leave the loose ends for you to tie up. A little food for thought.

Typical Applications

Program Listing 2 contains a 16K Level II Basic program that inpute mathematical formulas directly during program execution. After loading the machine code in lines 1000–1080, the program prompts you with "Z = ?" in the line 120. Respond with a mathematical expression

such as "2*3+4*SQR(6)/6". Line 130 adds the following:

- · CHR\$(2) turns on the video.
- "10 Z=", the program line number and "Z=".
- The formula you input, Q\$.
- ":?Z", to print the value of Z.
- CHR\$(13), the code for a carriage return. This enters the new line.
- The command RUN and CHR\$(3), which runs the program with the new line 10 added. CHR\$(3) Is the end of

	2600		99100	;		by HIRE GHAH	
	P600 F600		00110	ZSTART	EQU	0P600H S	
			90130	=======================================			
			99159	:THE VIC	PEO AND 1	BLOCK INITIALIZES KEYBOARD DRIVERS. GE ROUTINE	DEVICE CONTROL BLOCKS FOR BOTH RETURNS TO BASIC OR A CALLING
	F600	CD7FBA		USRMAC	CALL	BA7FH	GET USR PARAMETER
	F603		00180		INC	HL	POINTS TO STRING POINTER
	F604		00190		LD	E, (8L)	GET LSB OF STRING ADDRESS
	F605 F606		00200 00210		INC LD	HL D, (QL)	;CET MSB
	F607		00229		EX	DE,HL	1 SWAP BACK INTO HL
	F608			HACRMC	DEC	BL	MACBIRE LANGUAGE ENTERY POINT
	P689	2225F6 2A1E40	00240		LD	(NACPNT), HL	SAVE STRING POINTER
		2272F6	00250 00260		LD LO	HL, (401EH) (VIDOUT+1), HL	;GET VIDEO DRIVER ADDRESS ;SAVE IT TO RESTORE
	F612	2A1640	00270		LO	HL, (4016R)	GET KEYBOARD DRIVER ADDRESS
		2275F6	00280		LD	(KEYOUT+1), BL	; SAVE IT ALSO
		2166F6 221E40	00290 00300		LD LD	HL, NOVID	; NEW VIDEO DRIVER
		2127F6	00310		LD	(401EH),HL HL,HACHO	; PUT INTO DEVICE CONTROL BLOCK ; NEW REYBOARD DRIVER
		221640	00320		LD	(4016H),HL	PUT INTO DCB
	F624	C9	00330		RET		RETURN TO CALLER
	F625	0000	00340 00350 00360	HACPNT	DEFW	ØØN	; POINTS TO CHARACTER TO PASS
				THIS IS	THE AC'	THAT, AUTO-REY DE	IVER, IT CHECKS FOR VALID CONTROL
			00360	CHARCT	CRS (01	, 02, OR 03) ANI	GETS CHARACTERS IN THE STRING.
		3A4038	00390	HACRO	LD	A, (3840H)	TEST FOR "UP ARROW"
	F62A F62C		00400		CP JR	8H	.CAUCEL AUMO_POV
		3A2240	00420		LO	Z,MACOUT A,(4022H)	; CANCEL AUTO-REY ; GET CURSOR CBARACTER
	F631		00430		OR	A	; IF CURSOR IT NOT OH,
	F632		09440		JR	Z, KEYOUT	; EXIT VIA HORMAL KEY DRIVER
	F637	2A25F6	00450		LD INC	HL, (MACPNT) SL	GET CHARACTER POINTER BUNF TO NEXT ONE
		2225F6	00470		LD	(HACPNT), BL	SAVE IT FOR NEXT TIME
	F638		00400	•	LD	A, (BL)	GET THE CHARACTER
	F63C		00490		CP	01B	TEST FOR "VIDEO OFF"
	F63E	2008 2166F6	00500		JR	HZ,MACON1	GOTO HACORI IF NOT 01
	F643	221E49	00520		LD LD	HL, NOVID (401ER), HL	; VIDEO OFF DRIVER ; PUT IN DCB
	F646	AF	00530		XOR	A	RETURN ZERO (NOTHING)
	F647 F648		00540	uacon1	RET	D2	ENO NUMA VEVE
	F64A		98568	HACON1	CP JR	B3 HZ,MACON2	; END AUTO-KEY? ; GOTO MACON2 IF NOT
	F64C	2A75F6		HACOUT	LD	HL, (REYOUT+1)	RESTORE ORIGINAL KEYBOARD
		221640	00580		LD	(4016H),RL	, DRIVER TO DCB
		2A72F6 221E40	00590 00600		rd rd	HL, (VIDOUT+1)	RESTORE ORIGINAL VIDEO
		3EØD	00610		rd rd	(401EH),HL A,DDH	; DRIVER TO DCB ; RETURN A 'ENTER'
	F65A	C9	00620		RET		ROUTINE NO LONGER LINKED
		FE02		HACON2	CP	92H	VIDEO ON?
	F65D F65E	2A72F6	00640 00650		RET LD	NZ HL,(VIDOUT+1)	; NO, RETURN VALID CHARACTER ; ORIGINAL VIDEO DRIVER
		221E40	00660		LD	(401EH), SL	RESTORE DCB
	F664	AF	99679		XOR	A	RETURN ZERO
	F665	C9	99699		RET		
			00690	THE FO	LLOWING	ROUTINE TORRS VI	DEO OFF BY SCREENING ALL
							14) AND CURSOR OFF (15).
	F666		00720	MOVID	LD	A,C	REGISTER C BOLDS CHARACTER
		7 E Ø E 2 8 Ø 6	00730 00740		CP JR	14D	CURSOR ON CODE?
		FEOF	00750		CP	Z,VIDOUT 15D	;YES, PASS IT ON ;CURSOR OFF CODE?
	F660	2892	00760		JR	2,VIDOUT	YES, PASS IT ON
		9E99	99779	W.D.Ou.	LD	C, ØB	PASS A ZERO (NOTHING)
		C30000 C30000		VIDOUT KEYOUT	JP JP	9999H 9999R	REPLACE 0000H WITH ORIGINAL
	F677	~20000		ENDMAC	EQU	\$	DRIVER ADDRESS AT START
	402D		00010		END	402DH	CNANGE TO 1A19H FOR LEVEL II
					Drogen	m Lipting 1 Auto	kov
					riogia	m Listing 1. Auto-	noy
_						<u> </u>	

string code for Auto-key that returns Enter for the last command.

Line 140 executes a USR call to enable Auto-key. The command Stop does two things. First, you can't enter a program line during execution, and second you need to have the cursor on to activate Auto-key. The cursor needs to be on because Basic is continuously scanning the keyboard looking for a Break key or setting INKEY\$ values. Without checking for the cursor, Auto-key would be returning the first part of your string before Basic found the stop statement. Try running the program, inputting various expressions, and then hit Break and list the program. The last expression you enter will be in line 10. "BREAK IN 140" is never displeyed because Autokey is initialized with the video driver disabled. Disk Basic users will have to reassemble Auto-key into higher memory and use the DEF USR1 = &Hxx-xx statement to define the user entry point.

Program Listing 3 conteins e Disk Basic program that lists the disk directory, returns to Disk Basic and resumes execution. Since the program operates in a similar manner to Program Listing 2, I will explain the target string (DIR\$) only.

- CHR\$(133) is the Basic internal code for CMD.
- •The CHR\$(34)s put quotes eround S. So far we have CMD"S".
- CHR\$(13) and CHR\$(2) add Enter and turn on the video, respectively.
- •"DIR (A, I, S,)" end CHR\$(13) execute the directory read with file allocation, invisible files and system files.
- •CHR\$(01) turns the video off again.
- •"BASICR" and CHR\$(13) re-enter Disk Basic with the program and all variables in-

tact.

- •CHR\$(179) is the Basic Internal code for CONT.
- CHR\$(3) terminates Autokey and returns an Enter. The Basic program now resumes execution at the 140.

Program Listing 4 is an example of auto power up to Diak Basic. This routine is pert of a lerger program called Control, that contains my upper/lowercase driver, joystick driver, screen print driver, home interface controller and Auto-key.

TRSDOS ellows one power up command via the Auto command. Auto loads Control on power up with the execution address as line 110 (COMPRC). From there Auto-key takes over

Line 110 calls a routine that initializes my DCBs to point to various drivers so that when Auto-key is finished these pointers will be restored. (Line 110 is only necessary if you use driver routines of your own).

Next, line 120 loads register HL with the string address called MACBUF. Line 130 calls Auto-key's machine-code entry point (MACHMAC in Program Listing 1).

Lines 140-150 perform a very neat trick. Memory location 4049H contains the TRSDOS top of memory pointer. If you alter this pointer, your TRS-80 thinks it only has memory up to that number. Since Disk Basic uses the top 64 bytes of memory for initialization, any code in the top 64 bytes of high memory will be clobbered. By changing the top of memory pointer to en eddress lower than any of your routines, you can evold this problem. You can enswer the memory size question with Enter and both Basic and TRSDOS will leave this high memory alone.

Line 160 jumps back to TRSDOS where it turns on the cursor and calls the keyboard driver. Auto-key intercepts and passes back the string in lines 170-270. Line 280 terminates Auto-key's control.

With some further effort, you can construct more complex programs during run time, using Auto-key.

```
1B GOTO1088: REM NENORY SIZE = 32628
188 CLEAR388:OEFINT A-2
118 PORE 16526,136:PORE 16527, 127 : REM AUTO-REY ENTRY POINT
128 INPUT"2= ";0$
138 OS=CHRS(2)+"18 Z="+OS+":?Z"+CERS(13)+"RUN"+CERS(3)
148 X=USR(VARPTR(OS)):STOP
1888 FOR Z8= 32648TO 32767:READ Z9:POKEZ8,Z9:NEXT Z8:GOTO188
1818 DATA 285,127,18,35,94,35,86,235,43,34,173,127,42,38,64
1828 DATA 34,258,127,42,22,64,34,253,127,33,238,127,34,38
1838 DATA 64,33,175,127,34,22,64,281,8,8,50,64,56,254,8,48
1848 DATA 36,5E,34,64,183,46,64,22,173,127,35,34,173,127,126
1858 DATA 254,1,32,8,33,238,127,34,30,64,175,281,254,3,32
1868 DATA 15,42,253,127,34,22,64,42,258,127,34,38,64,62,13
1678 DATA 261,254,2,192,42,258,127,34,38,64,62,13
1678 DATA 261,254,2,192,42,258,127,34,38,64,62,13
```

Program Listing 2. This Basic program will list mathematical formulas during a program's execution.

```
58 REM CBR$(133) = "CMD", CBR$(179) = "CONT"

1BB CLS:CLEAR588:DEFINTA-Z

118 DIR$=CBR$(133) + CBR$(34) + "5" + CHR$(34) + CHR$(13) + CBR$(2) + "DIR (A,I,S)" + CHR$(13) + CRR$(81) + "BASICR " + CBR$(13) + CBR$(179) + CBR$(3)

120 PRINT ACCESSING DIRECTORY"

130 DEFURSI = EFFFF3: E-USR1(VARPTR(DIR$)):STOF:REM FFF3B IS JUNF V ECTOR FOR AUTOREY

140 PRINT DIRECTORY READ":END
```

Program Listing 3. This Disk Basic program lists tha directory and resumes programming.

```
00180 :
                                           CONTROL V 6.2
                                                                       2/23/81
UNDEFIRED SYMBOL
                BB11B COMPRC
8888 CD8888
8883 211288
                                 CALL
                                           SETUP
                                                               ; SET DC8, s. OPTIONAL
                 88128
                                           HL, MACBUF
                                  LD
                                                               STRING ADDRESS
UNDEFINED SYMBOL
8886 CD8888
8889 2188EF
                 88138
                                  CALL.
                                           MACHMO
                                                               ; AUTO-REY ENTRY POINT
                                           RL, 0EF88R
(40498), RL
482DR
                 00140
                                  LD
                                                               SET TOP MEN
000C 22494B
B00F C32D4B
8012 82
                 88158
                                  LD
                                                                  TO EFERS
                                                               1 DOS
                 44160
                                  JP.
                 88178 NACBUF
                                 GEFE
                                                               VIDEO ON
                                            #28
                                            VERIFY (ON)
                                                               ; VERIFY WRITES
0013 56
                 88188
                                  DEFN
GALE BO
                 BRIGA
                                  DEFE
                                           ADR
001£ 43
                 88298
                                            CLOCK (ON)
                                  DEFN
8829 80
8828 42
                 88218
                                  OEFB
                 88228
                                  DEFN
                                            BASICR'
                                                               :LOAD DISK BASIC
                                           BDB
                 00230
                                  DEFB
8831 80
8832 36
                 88248
88258
                                  DEFE
                                            ¢DB
                                            61888
                                  DEFM
                                                               MENORY SIZE. OPTIONAL
B#37 #D
                                            BDR
0838 52
                 40278
                                  CEFH
                                            RUN"WATCH"
                                                               HONE WATCHER
                 88288
                                  DEFB
                                            43H
                                                               : END OF STRING
AGRA
                 88298
BBB02 TOTAL ERRORS
```

Program Listing 4. Automatic Power-up to Disk Basic.

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Debug With GOTO

Roger L. Pape 7545 Marble Drive Liverpool, NY 13088

You've just spent hours entering data into a program and then it "bombs out." Is there a way to continue without losing all your data? How about making changes in the source statements of the program and continuing without losing the data? Or would you like to run one program and have it load another program which uses values from the first?

Problem and Its Solution

Preserving e lot of data already in memory became a real problem for me one evening. After several hours entering a large number of long character strings, I was confronted with an OM Error message as the program terminated. Typing RUN would wipe all the data out! I observed that the point after the run command performs its initialization is equivalent to the GOTO statement processing. One can type GOTO nn (where nn is any existing line number) and reenter the program at the statement without losing the variables already stored in memory. A simple GOTO the cassette output section of the program end my data was saved. Reading the Level II manual later, under the description of the GOTO statement (section 4) was the solution I had discovered.

A GOTO in the commend mode is a perfectly valid way of starting or reentering a program. Any variables created in the previous execution or those defined by assignment (Let) statements in the command mode before starting are preserved. The GOTO can be directed to any valid line number in the program with severel restrictions. First, the Clear statement will clear the variable storage area (actually only resetting the storage pointers to the beginning of the storage area). If the Clear statement is executed when the program is re-entered, previously generated values are lost. Secondly, a variable cannot be redimensioned. Once an array has been created and stored, do not reenter at or before a Dimension statement containing that variable name.

Dabugging with GOTO

GOTO can be used very effectively when debugging programs. Consider the following situation where a statement such as:

200 A = X /Y

is somewhere in the middle of a program and the value of Y is undefined (or zero for any other reason). The program will stop at this point with a /0 (division by zero) message. To correct this problem, one can enter an appropriate value for Y and continue by typing:

Y = ____ GOTO 200 (both in the command mode)

and check the rest of the program. Frequently this can eliminate the need to

reenter a long series of input that would otherwise be required to run the program from scratch.

Level I vs. Level II

After a program is stopped, the values of the variables used during execution remain in memory. Likewise, any variables defined in the command mode will modify the values previously stored or will be added to the storage area if the variable had not been encountered earlier. The only reason the variables cannot be accessed when the run command is reissued in a Level II system is because the pointers which define the storage areas are reset.

The Level I system software does not reset the variable storage pointers when the Run command is processed. Therefore, preset the value of any variable before the run command is typed and the values will be used in the program. But the Level II software resets the variable storage pointers when the run command is processed. So any predefined variables will be lost when a Run is issued. The preset variables in a Level II system, type the variable assignments statement in the command mode (as in Level I), but then type GOTO nn (where nn is a statement number at the beginning of the program) in order to start execution. Avoid any Clear statement in the program, If added string space is required, type the appropriate Clear statement before presetting the variables. (The amount of string space reserved by a Clear statement is remembered from one program to the next. It only changes when another Clear statement is executed or the memory size is set. After running a program which uses large amounts of string space, it's a good idea to type Clear to free some of the memory.)

Unfortunately, continuing execution is

"Once you are able to chain, you are free to edit a program and restart it without losing variables."

not as simple if the source program is changed. Whenever another program is loaded or when statements are Inserted, deleted, or edited in a program that is already in memory, the variable storage pointers are reset. You could include a cassette load stetement at the end of one program to load a second program, but variables from the first program are not accessible in the second program (unless written to some storage medium). Likewise, if any changes are made to the program statements, you cannot normally continue execution at some intermediate point (as in the division by zero example).

With a few software changes you can preserve variables in mamory for use later. Since the procedures required to save the variables while aditing the source statements are assentially the same as those needed to transfer values from one program to another when chaining, it is relatively elficient to provide both capabilities in the same pitch. Let's first review the memory allocation in a Level II system.

Memory Map

The way variables are stored in a Level II TRS-80 is illustrated in Fig. 1. This memory map shows the relative positions of the various storage areas in the user's memory as a program is loaded and executed. The values in parentheses on the left of the map are the locations (in hexadecimal) of the word pairs used to store the 16-bit addresses of the current starting point for each of the specified areas. The tirst location contains the lower byte of the pointer, while the next location contains the upper byte.

Variables are stored immediately after the Basic source statements. This area is subdivided into two sections. The first contains simple non-dimensional variables. while the second contains all the arrays (dimensioned variables). The pointer stored at locations 40F9/AH is the start address for the simple variables. The pointer stored at locations 40FB/CH is the start address for the array variables. Finally, the pointer stored at 40FD/EH is the start of the free space. The tirst of these three pointers is set after the program source statements have been entered and remain the same while the program is running. But the latter two pointers will change velue during program execution as new variable names are encountered and their values are stored.

The Basic interpreter storas tha variables sequentially in the order that they ere encountered as a program is run. What gets storad is a combination of the variable type, name and value.

Each simple variable consists of a variable type flag (which is equivalent to the number of bytes needed to store the value),

two ASCII characters representing the variable name (the second character of the name, if it is used, or else a null is stored lirst), and the current value of the variable.

Array storage also includes overell length and dimension information. The name is followed by a two-byte value representing the remaining bytes for the array, then one byte for the number of dimensions and two bytes for each dimension to store its size (the last dimension is atored first). As a variable name in a program statement is interpreted, the storage area is scanned from the beginning to see whether this name and corresponding type are already stored in the list. If not, the variable is added at the end of the appropriate area. Array storage space is created when a dimension statement is interpreted. That is, the veriable name is entered in the list and the necessary space reserved with the contents in-Itialized to zaro. If a new erray name is encountered in any other statement (without previously being dimensioned), it is automatically dimensioned with an upper limit

Because simple variables and arrays are stored in separate areas, one can use an identical name for both. In addition, if the explicit type flags are used with the name, separate variables are created since both the name and type must match. That is, X%, X#, X!, and X\$ are all distinct veriables. Therefore, it is possible to have a number of different variables with the seme one or two-character name. The Basic Interpreter keeps tham straight because it can determine whether the variable is dimensioned from the use of subscripts and also determine the variable type, based on the default type corresponding to the first latter or from an explicit type flag. All these conditions must match an entry in memory or else it is assumed to be a new variable and a new entry is created.

Scanning the variable list can involve considerable processing time. Variables are not stored in any prescribed order. Integers, single and double-precision floating point values, and string variable parameters are intermixed. So the seerch for a variable involves beginning at the start of the storage area and examining each variable name and type until a match is obtained or the end of the area is reached. In the case of simple variables, the verieble type liag conveniently provides the number of bytes to skip over for the start of the next variable.

In the case of arrays, its length, stored

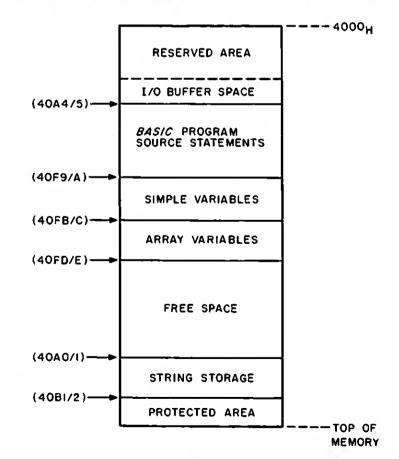


Fig. 1

"With a few software changes you can preserve variables in memory for use later."

Immediately after the name, functions the same way. To save time during the scanning process, this value is computed once when the array storage space is first created. The number of bytes that follow is given by the byte length for the variable type times the product of the dimension, plus the number of bytes needed to store the dimension Information. Then, when arreys are scanned and the variable name or type does not metch, this value is read end quickly locates the start of the next erray. Since the storage area must be scanned each time e varieble is used, a time-saving tip is to declare the most frequently used variables early in the program so they are stored near the beginning of the list. Potentially, this could save considerable execution time in lengthy programs with large amounts of repetitive calculations.

Because the variable storage erea immediately follows the progrem statements, increesing the progrem length, either by editing or loading a new progrem, will overwrite the old verieble storage area. Any time a program is loaded or an existing program is edited, as well as when the Run commend is issued, the pointers which define the extent of the variable storage sections are all initialized to the location after the end of the program code. This is interpreted as en empty storage space.

One other point that will effect your program is the wey string variables are stored. The string information stored in a variable storage block consists of the type flag (3), the number of characters in each string and the etart eddress for the actual string. This information is intermixed with the other variable types in one of the two variable storage areas, depending on whether it is a single string or an array of strings. If a string

variable is entered via an input statement or is generated by a string function or by the concatenation of several strings, the actual string of ASCII characters is stored in an area of upper memory reserved for strings. But If the complete string is defined in an assignment statement of the program, such as:

500 A\$ = "THIS IS A STRING"

or in a data statement, the string is left in the program area. This approach conserves etorage space, but results in strings being scattered throughout memory. If strings stored in one program are to be used by another chained program, it is necessary to extract strings from the program area and save them in the string storege space.

The Chain Command

So, these are the required steps for chaining in Level II:

- Store ell variables, including embedded strings, in the upper part of memory and protect them.
- · Load the new program.
- Move the saved variables back down immediately following the program statements.
- Start the new program without resetting the variable storage pointers.

The first three steps in this process ere illustrated in Fig. 2. Relocating the strings that are embedded in the program statements can be handled quite easily with an existing system routine in ROM. As these strings are moved, it may be necessary to expand the string storage area, so the string relocation should be performed before the variable block is moved.

Once you ere able to chain, you are free

to edit a program and restart it without loslng variables. Before making any changes to the program statements, perform step 1 above. The editing or statement additions/ deletions would be made (in place of step 2) using the normal system commands. After all changes have been entered, steps 3 and 4 are performed to repack the variables at the end of the corrected program and restart the program at the desired point.

Summary

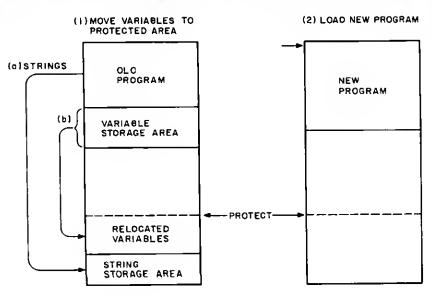
Chaining is useful in a variety of situations. For example, you may have a program requiring the results of a previously run program. Rather than modify an existing program, it may be more convenient to write a separate program called by a Chain command to preserve the results of the first program. Breaking a large program into several smaller routines (which are chained) is almost equivalent to having more memory.

Another memory saving application involves programs with extensive internal data storege. Once data statements are read, they are essentially wasted space. An alternate approach is to have a separate preliminary program consisting of read and data statements to preset the variables and then chain the main program.

The proposed cheining software also lets you resume your program after editing with little memory loss.

The concluding portion of this erticle will describe the actual Chain command for Level II, including the complete assembly code. It is completely relocatable and automatically installs itself immediately below any other patches previously loeded, such as key debounce, lowercase, or whatever other fixes you may already have in your system.

(3) RESTORE VARIABLES



NORMAL VARIABLE STORAGE

Fig. 2

At home on the Mod I and III.

DOSPLUS 3.3

DOS PLUS 3.3 Microsystems Software, Inc. Hollywood, FL \$99.95

James LaSalle M.R. 2 Bock Lane Baden, PA 15005

A titulis writing there is only one serious double-density DOS available: DOS-PLUS 3.3. It not only reads single density TRSDOS, LDOS and NEWDOS/80 diskettes, but reads standard Model III TRSDOS diskettes; and the Model III DOSPLUS reads and writes diskettes that are compatible with the Model I.

However, specialized disk I/O files and hardware-dependent features cannot be shuttled between the machines. The little gem that lets the Model I read Model III TRSDOS diskettes is the Convert/CMD utility. Convert:1:0 makes the required adjustments to allow access to Model III diskettes.

DOSPLUS 3.3 allows mixing of various track drives. The Format/CMD utility formats disks for the desired track count and storage mode (double or single density). Once this is done, DOSPLUS 3.3 takes care of all housekeeping. LDOS/VTOS handles the different track drive problem in the same manner. If specifying the track on each format is disturbing to you, Config will allow you to preselect the track count and stepping rete, operate with a clock speed modification installed, configure a drive as double sided, (you can only configure the system drive to a certain track count) and if

your printer can handle them, send unaltered graphics codes to the printer.

Trensfer Your Library

You may want to transfer your program library from single to double-density format. Unlike Percom's DBLDOS that requires you to manually copy all filespecs, DOSPLUS does this with the Transfer/CMD utility. DOSPLUS reacts to the disk format (double or single density) and transfers files from disk to disk in the appropriate mode.

First format the destination disk in double density and execute Transfer :s :d (:s equals source drive, :d equals destination drive). DOSPLUS moves all visible files with no user intervention.

Directory

LIB gives you a look at a respectable library of DOS commands. Many of the famillar ones have been extended. DIR typities the library enhancements. With most DOSes (LDOS excepted) the directory lists only the visible files on a disk; however, with DOSPLUS 3.3 the information is much more thorough.

The first line of the directory lists the drive number, disk name and date, version of DOSPLUS and density mode. The files are then described with various parameters. The ATTRB column first tells if the file is visible, invisible or deleted. The asterisks denote a user file. An S in the second ATTRB column would denote a system file. Next a U, A or B tells if the update, access or both passwords are set. The last ATTRB column tells the protection level set.

The directory also indicates the number of records on file, number of sectors, number of granules used, and if the file is written on consecutive tracks. The last directory line tells how much storage space remains on the disk.

A double-density disk filled with small utility programs easily fills several video screens in this format. This is not incon-

venient because the system pauses after the video is full and waits for user instructions to proceed.

Other Commands

Free has been altered to graphically display the tracks currently being used on a specified disk instead of the amount of free storage left. This is a quick way to see how many tracks on a disk have been formatted where the directory is located and which tracks have been locked out.

Date can be set at power-up and is the default value for backups end format functions. DOSPLUS retains the date unless the system is rebooted. Copy has been streamlined to copy filename:s:d. This copies a file from drive:s to drive:d. Single-drive users are not forgotten. A special utility, Copy1/CMD, allows single-drive copying of all file types. Create preallocates disk space for a specified file. Debug can now be entered with a shift Break. Device displays current I/O devices and their vector addresses.

DOSPLUS 3.3 for TRS-80 Model I currently supports only three devices: keyboard, video monitor and printer. The RS232 is not defined at this time. Not implemented in this version of DOSPLUS are Link (I really miss this one), Sat, Reset and the ability to route to a disk file.

Bulld-Do Commends

Chaining is available with the Build-Do commands. Build allows the user to create a sequential set of tasks for DOSPLUS to perform. A Do file may be created with Build to get a directory, display the Free map, load a printer driver, set Basic memory size, and jump to Basic. Build is completely self-prompting. A Pause command may be inserted in the Build file to allow for user intervention. Peuse does not allow for user entry of commands.

Do checks high memory (4049H-404AH) and reserves about 300 bytes at the top of memory for itself and a small buffer. After

252 • 80 Microcomputing, October 1981

"There is only one serious double-density DOS available: DOSPLUS 3.3."

Do executes, this memory space is returned to the system.

A problem arises when a high memory program (printer driver, machine code sort, etc.) occupies the same memory area that Do usurps. Trying to Build a file that first loads the GSF (Racet computes) sort module into high memory is disastrous. When Do loads GSF, it obliterates its buffer and all Build instructions are lost.

The Forms command controls printer page length, the number of printed lines per page, the number of characters per line, and can output to a serial printer. It can also generate an automatic line feed on carriage return and perform a top-of-form.

A hard (printer generated) top-of-form is not implemented on my Okidata Microline 80 printer. Having to include paging modules in my programs has been a minor inconvenience in the past, but DOSPLUS 3.3 eliminates the need for extra page formatting code. On power-up the Forms parameters are set to standard values. To view the current status of the Forms driver type: Forms (enter). This also eliminates the need for any high memory printer routines. Since Forms is a library function these LPRINT/ LLIST parameters are available for all printer output-even Basic listings!

The only minor irritant is that the TRS-80 Model I LPRINT line counter (found at 16425 decimal) is decremented with each printer code. In the Okidata Microline 80 printer expanded print is available by typing LPRINT CHR\$(31); a return to normal print is LPRINT CHR\$(30). The Model I and the Forms driver count each of these codes as a line printed and increment the LPRINT line counter. This could lead to a problem with printed output creeping down the page.

When I do not want Forms control I disable it by typing: Forms (L = 66, P = 66). This sets the page length end number of lines printed per page equal to 66. If I want a Basic program listing to accurately paged, I initialize the LPRINT counter by typing: LPRINT CHR\$(12).

PROT has been expanded to allow the changing of a disk's name as well as the usual password manipulations.

Utility Functions

There are about a dozen programs listed in the utilities section of the DOSPLUS 3.3 manual-all of them extend the versatility of the system. By being discrete about which utility functions become programs, relatively small system disks can be created. This provides the single-disk user with maximum storage space per disk.

CLRFILE zeroes a file but does not reallocate its storage area. This could be useful when using a disk for temporary files, CLR-FILE has the same overall effect as the library command Create.

Copy1 is a necessity for single-drive users. It permits single-drive disks to transfer all types of files. Both LDOS and NEWDOS/ 80 have this feature, but it is closely tied to the system. Copy1 will probably be little used by multiple-drive users.

Crunch is little changed from DOSPLUS 3.1. It is a utility to eliminate Remarks and extra spaces in Basic programs.

DiskZap has been amended to read single or double-density disks. Its capabilities are similar to Apparat's SuperZap. In its current form it does not generate hash codes or passwords. Conspicuous by its absence is SuperZap's DFS function. This permits examining or modifying by file name rather than by sector. Micro-Systems Software chose to provide this ability in e stand-alone machine language DiskDump program. Paging is slightly Improved over SuperZap. Taken together these utilities should keep most disk zappers happy. Documentation is adequate for both utilities.

Purge allows you to rid a large number of files. Purge :0 (I) presents the user with a menu of visible and invisible files to be marked for deletion. Passwords are transparent to Purge so all files may be killed. With a handy program of this type it is easy to become over-zealous and kill the wrong file. The Restore utility, fortunately, resurrects the kill file as long as it has not been overwritten by another program or CLRFILE has not been used on it.

Map shows what tracks and sectors each file occupies. The value of this utility becomes evident when two disk systems of different track counts are used.

Spooler

Micro-Systems also provide an adequate spooler with DOSPLUS 3.3. The spooler uses an operator-defined memory buffer and an optional disk file for printer output. Spooling becomes a semi-background task allowing the host program disk I/O. This is accomplished by halting printer operation while the disk drives are being accessed. If the operator was too conservative in the allocation of spooling memory space, the spooler will temporarily seize CPU control until the spooler buffer is cleared of its backlog. Other than this, the operator is barely aware that the spooler is active. You



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"The SR/CMD module is unique...you expect to find this feature in a word processor."

can even list the spooler's disk file and printing still continues.

Deactivating the spooler requires rebooting the system. Since the spooler and the Do buffers can be co-resident, the spooler can be activated from a Build/Do file.

Disk Basic Version 1.4

DOSPLUS Extended Disk Basic Varsion 1.4 is authored solely by Micro-Systems Softwara, but I have not experienced a compatibility problem between DOSPLUS Basic and the MicroSoft/Tandy Extended Disk Basic. The only areas of incompatibility I ancountared was with the specialized disk I/O file structure of NEWDOS/80 and with antry into Disk Basic itself. When antaring DOSPLUS Basic, no file buffars (channals) ara allocated. With other DOSes the default value is three buffers rasarved. You must axplicitly rasarva I/O buffers when entering DOSPLUS Basic. The syntex for this also differs from the norm. The command: Basic fileneme-F:3-M:65237 loeds Basic, reserves thrae I/O fila buffers, protects mamory above 65237 and loads and axacutas tha program specified in filenama.

DOS commands from Basic have been simplified to: CMD"DOS command", DOS-PLUS 3.1 used CMD"I", "DOS command". A plain CMD raturns to DOS, RENUM, SR and REF ara called from Basic using CMD.

Basic has aditing and kayboard shorthand. Pressing the samicolon displays the first line of code; pressing the slash key displays the last. Pressing L lists the entire program. The DU end DI commands allow the duplication and delation/insertion of a program line. An L"fileneme" loads a program and e S"filename" savas it. Similarly R"filename" loads and executes a program.

Ranumbaring is adequate. To ranumber a Basic program typa: CMD"RENUM", n,i,s,a. Where n equals naw line, i aquals increment, a equals start lina, a aquals and lina. Unlika NEWDOS/80, DOSPLUS 3.3 will not allow block moves vie the RENUM commend.

The SR/CMD module is unique in that it ellows the progremmer to search and replace a string variable or expression. You expect to find this feature in a word processor. I am sure this is one feature that future DOSes will incorporete.

REF/CMD is a variable cross rafarenca. CMD"REF", K,L,V lists references in a Basic program by kayword, line number or variables. To obtain hard copy just append a P to the specification list.

CMD"M" is a kind of dynamic variables

list. Stop a program at any time during execution and type CMD"M" and all variables are listed along with their current value. The dabugging value of this command should be obvious.

Tha Traca function has been ravamped to singla step through Basic displaying program lines before executing tham. This, along with CMD"M", has significantly reduced program debugging time for me. TRON turns on the trace and pressing any key single steps through Besic. Since only one instruction is displayed at a time, the video display is much easier to interpret. If Devices were fully implemented, the video monitor could be Linked to the printer to display the trace simultaneously on the monitor and printer. In the absence of Link the video could be Forced (Routed) to the printer.

Appanding a ,V after a file to be run saves all current variable values. This ellows passing variables from one Basic program to another. The result is true chaining. An index array could be established with an initialization program and passed to other programs.

Fila handling anhancements with DOS-PLUS include variable record length files. This makes ISAM techniques possible. With variable record length files, the programmer no longer hes to calculate subrecords. If e logical record length turns out to be only 100 bytes, then Opan"R",1, "filename",100 opens buffer one for a record length of 100 bytes. Micro System's TEST-PGM program amply illustrates this technique. Other than this sample program there is little explanation on the utilization of veriable record length files.

In addition to the variable length files, Open"E" and Open"D" are available. Open"E" allows the extension of a sequential file without reading the entire file into memory and writing it back to disk. Open"E" causes new records to be added to the file on disk and the EOF marker adjusted. Open"D" seems to be synonomous with Open"R". It has been included to be compatible with TRS-80 Model II syntax.

Micro-Systams Software raworked Basic in DOSPLUS 3.3 quita extansivaly. Actually two Basics are provided: a full-feature Basic/CMD and an abbreviated TBasic/CMD. TBasic is meant to be used after a program is debugged and the verious debugging utilities are not needed. This provides the user with more memory space for data. Not included in TBasic are the CMD function, editing and keyboard shorthand,

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Despite th industry, it

"The shortcomings of DOSPLUS 3.3 are few and reflect my personal preferences...the literature is adequate for an experienced hacker."

or full error messages.

Shortcomings

The following shortcomings of DOSPLUS 3.3 are few end reflect my personal preferences: no DOS high memory command; lack of complete Device handling; no DOS Boot command for a warm reboot; the elimination of the Besic2 library command; and finally, only fair documentation. The literature is edequete for an experienced hacker, but may not suffice for an entry-level user. I especially miss a section on DOS calls.

There is also some conflict between DOSPLUS' keyboard routine and some Level II programs. Radio Shack's Haunted House adventure and Astrology are representative of this problem. Both programs were put on disk with Apparat's LMOFF-SET. Executing either of these programs under NEWDOS/80 requires disabling the

keyboard debounce routine. Small Systems Software's DCV-1 tape-to-disk utility solves this problem, however. DOSPLUS has no way to disable debounce so neither of these programs can be easily executed!

Assessments

My overall evaluation of DOSPLUS 3.3 is that it is a stable, efficient, fest end easy-to-master DOS. However, if you have mastered NEWDOS/80 you would probably miss many of the Apparat's extra enhancements (mini-DOS, block move of Basic code, etc.) if you adopted DOSPLUS as your bread-and-butter DOS.

The mejor factor in weaning me away from NEWDOS/80 was DOSPLUS' portability from Model I to Model III (and back again), and the ease with which it interchanges single and double-density diskettes. The standard features of DOSPLUS have been the basis for many stand-atone utilities. If noth-

ing else was considered but this factor, DOSPLUS is a bargain. I have not used NEWDOS/80 with double-density zaps since ecquiring DOSPLUS. A business cen do little better than DOSPLUS for TRS-80 Model I or Model III.■

Author's Note: The Config commend can only configure the system drive to a certain track count. Disks intended for drives with a track count different from the zero drive must be defined with the Format utility. The Config command may still be used to vary the stepping rate and number of disk sides for any drive as mentioned above.

Micro-Systems also tells me that Small Systems Software's DCV1 tape-to-disk utility will set the proper Level II keyboard values for correct operation. This means that DOSPLUS' debounce routine is no longer a serious problem for those few programs that require a Level II keyboard.

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All About Program Files

A. J. Barnard, Jr. J. T. Baker Chemical Company Phillipsburg, NJ 08865

A. David Barnard Rensselaer Polytechnic Institute Troy, NY 12181

anaging a small date bese with cassette storage end a Model I can present problems. One problem is the low rete for data transfer and the limited reliability of the tape system. This problem is eesed by hardware and eoftware fixes such as the TC-8 caseette operating system.

A second problem stems from the nature of the records forming the date base. If the records are of variable length, alphanumeric, and not closely formatted, difficulties are magnified in the use of either date stetements or a seperately maintained cessette file; memory overheed for arrays and strings may be substantial.

With such records, a third approach can be considered—use of e program file.

The Program File

In a program file each record is stored as a statement ageinat a line number. A program file becomes especially attractive if values for a significant parameter can be encoded as line numbers. For a program file, ell the built-in, line-oriented subroutines of the programming language ere available, notably the arrangement of records by the line-number-encoded parameter regardless of entry order. In this respect, a progrem file ie a linked file.

A PEEK routine that steps through the file retrieves records from a Basic program file. When a line number in the seerch renge is found, the asacclafed record is recovered, manipulated and displayed by the string-handling capabilities of Basic.

Each record is entered egainst its eppropriate line number just like a program statement with one important difference: A double quotation mark must be entered following the line number and before the proper record. The record is stored in the ASCII values of the characters and any embedded Basic key word (e.g., On, And, End) or control character is not interpreted as such. The double quotation merk ensures cleer printing.

Ratrieval of Records from a Basic Program File

The elements of a program to retrieve recorde from a Basic program file are highlighted by Progrem Lleting 1. Line 0 clears space, principally for the string R, in which a recovered record is pleced. Line 0 also definee the Integer and string variebles and then GOTOs the operating program et line 5000. Lines 1 through 4999 are thereby reserved for the program file. The first and last records, FR end LR, to be retrieved are input in response to lines 5000 and 5010. Line 5020 checks for entry errors.

The pointer to the stert of a Basic program is at decimal address 16548 (40A4H) (least significant byte) and 16549 (40A5H) (most significant byte). For the atendard Model I with 16K the location pointed to is 17129 (42E9H). This location X, and the next one, X+1, hold the two-byte pointer to the eddress at which the next line begins.

The next two positions, X+2 and X+3, contain the two-byte value of the current line number, L. The statement associeted with this line number begins at X+4 and ends with a null byte (character code zero). This description explains the sequence of line 5030 (address, first line), 5040 (line number, current line), 5060 (if line number in scen range, reading of record into string R until null byte is reached), and 5090 (address, next line).

The string R is printed by line 5080 with the line number, and R is nulled for reuse. Line 5050 checks if the current line number is within the search range. If below, the scan continues by lines 5120, 5040, and back to 5050; if beyond, e new search Is

prompted (lines 5110, 5120 and back to 5000).

If the records of the program file, for example, held employee information by an alphebetically ordered time card number, the first two records might read:

1"AARON, MORRIS: HIREO 7/18/75; DEPT. 10 9"ALBERS, KARL: HIREO 12/15/60; ON LEAVE

A seerch for card numbers from one to nine or beyond would retrieve and display the same data.

This simple program can be applied to various small data bases by manipulating the string in which a retrieved record is placed. A practical restriction is that the program with an embedded file should CLOAD in not much more time than it takes to read an equivalent cassette file into e previously loaded program.

With 16K memory, an operating program should probably be less than 2.5K long and be packed by the use of multistatement lines, single-letter variables, DEF statements, etc., and by brevity in prompts and heedings. The records should be telegraphically styled including abbreviations, acronyme and codes that cen be replaced by full stetements using If...Then...Else sequences or lookup errays.

Program Listings 2 and 3 present two practical programs highlighting the use of Basic program files. They are tailored to the TRS-80, but can be adapted to other computers using Microsoft Basic. The listings have been made with line feeds and indents to improve legibility, but the programs should be entered without these niceties in order to conserve memory.

Daily Diary

Program Listing 2 is a daily reminder program. Lines 101 through 6031 are reserved for the program file and these numbers encode the month and day for a five-year period. For example, lines 101, 1301 end 4901 store the notes for January 1 for the first, second and fifth yeers. Year one is set as Y1 in line 10. The operating program consists of lines one through 85 and in execution requires only 1.8K of

"One problem is the low rate for data transfer and the limited reliability of the tape system."

memory with a record as long as 120 characters.

The search routine delineeted by Listing 1 appears in lines 40, 45 and 50. The first and last dates (FD and LD) to be scanned are entered in response to line 20. By lines 20–25, the scen range is placed in string W, which is used as a heading. The dates are encoded as line numbers by the expression for C in line 25. Line 30 checks for entry errors and a response requires that the entered range is the intended one.

A retrieved record, as string R, is analyzed by lines 55 and 60. First, introductory spaces or double or single quotation marks are stripped. Then, if the third character in the resulting string is a colon, the first two characters are placed in string S, which is then checked by line 60 for a code. For example, if "HO: begins a record, then Holiday is substituted. The codes can be personalized. codes can be personalized.

Line 65 converts a line number to the month, day and year, which is displayed as string V ("#######") (line 5) by the PrintUsing instruction.

Line 65, beginning with :MK=M, and line 70 form a day-of-week routine correct to year 2000. The abbreviation for the day taken from string T (line 5) is placed in string U by line 70. (To eliminate the day-of-week feature, delete the final statements of line 65, line 70, and the U; in the LPrint and Print statements of lines 75 and 80.)

If a printout is requested, fleg H is set (line 35) and the LPRINT statements of lines of line 65, line 70, end the U; in the LPRINT and Print statements of lines 75 and 80.) and 75.)

The displey is secured by line 40 (heading) and line 80 (records). When the counter J for the number of displayed records exceeds eight (line 80), press Enter for the next frame. After each record is printed, strings S and R are nulled for reuse. When the search is complete, line 85 prompts another. A daily diary file might start:

101"HO:NEW YR DAY-RUTH'S->DINNER 115"PD:IRS 4/4 EST TAX 117"CALL, JIM ABOUT FEB SKI WKEND

if Y1 = 81 (that is, 1981) in line 10, then the CRT display for a scan from 1,1,81 through 1,17,81 would be:

-SCAN 1/1/81 ->1/17/81-1/1/81-THR-HOLIDAY-NEW YR DAY-RUTH'S-DINNER 1/15/81-THR-PAYMENT DUE-IRS 4/4 EST TAX 1/17/81-SAT-CALL JIM ABOUT FEB SKI WKEND

If the diary becomes too long for a convenient CLOAD, the file for a completed period, say, six months, can be kept (with the operating program) as a separate tape by the use of the Delete and CSAVE instructions. Then only current entries need be

updated and searched.

Stamp Inventory Program

Program Listing 3 to an inventory program for a philatelic collection. The collection of stamps, of course, must obviously be sufficiently valuable, extensive,

or active to warrent computer management.

The operating program occupies lines 0 and 60000 on, and lines 1 through 59999 are reserved for the program file. The line numbers encode the catalog numbers of the postage stamps. The records need not

```
Ø CLEAR 300: DEFSTR Q, R, S: DEFINT F, I, T
   : CLS: GOTO 5000
5000 INPUT "SCAN FROM RECORD "; FR
5010 INPUT" TO RECORD "; TR
5020 IF FR < 1 OR TR > 4999 OR TR < FR THEN 5130
5030 X = PEEK(16540) + 256*PEEK(16549)
5040 L = PEEK(X + 2) + 256*PEEK(X + 3)
                                                  L > TR THEN 5110
5050 1F L < FR TREN 5090 ELSE
                                             IF
5060 FOR I = X + 4 TO X + 255
         IF PEEK(I) > 0 THEN R = R + CHR$(PEEK(I)): NEXT
5070 IF LEPT$(R,1) = CHR$(34) THEN R =
       RIGHT$(R, LEN(R) - 1)
PRINT L; "-"; R: R = ""
5000 PRINT L:
5090 X = PEEK(X) + 256*PEEK(X + 1)
 5100 GOTO 5040
5110 INPUT "ANOTHER SCAN (Y/N)"; Q
5120 IF Q = "Y" THEN CLS: GOTO 5000 ELSE END
5130 CLS: PRINT, "ERROR OR MISMATCH"
        : PRINT: GOTO 5000
                               Program Listing 1
```

```
5 CLEAR300:DEFINTD-K,M,Y:DEFSTRP-W,Z
    :V="##/##/##":T="SATSUNMONTUEWEDTHRFRI"
    :P="DAILY DIARY - BY A.J. & a.D. bARNARD"
10 Y1=01: Y1 SETS YR ONE
30 IPFD<1010RLD>6031DRLD<FDTHENPRINT, "ERROR1"
   :GOTO2@ELSEPRINTW::INPUT" (Y/N) ";Q
:IFO="N"THEN20ELSEIFQ<>"Y"THEN30
35 INPUT"PRINTOUT (Y/N)";0:IFO="N"THENH#0
ELSEIFO<>"Y"THEN35ELSEH=1:LPRINTW
40 CLS:PRINT, W:J=1:X=PEEK(16540)+256*PEEK(16549)
45 L=PEEK(X+2)+256*PEEK(X+3):IFL<FDTHEN50
    ELSEIFL>LDTHEN05ELSEFORI=X+4TOX+255:IFPEEK(I)>0
    TBENR=R+CHR$(PEEK(I)):NEXTELSEGOTO55
50 X=PEEK(X)+256*PEEK(X+1):GOTO45
55 X=LEN(R):RL=LEFT$(R,1):IFRL=" "ORRL=CNR$(34)OR
   RL=" ' "THENR=RIGHT$ (R,K-1) : GDTO55ELSEIF
   MID$(R,3,1)=":"THENS=LEFT$(R,2):R=RIGHT$(R,K-3)
60 IFS="HO"THENS="HOLIDAY-"ELSEIFS="VA"THENS=
   "VACATION-"ELSEIFS="BI"THEN, S="BIRTHOAY-"ELSEIF
S="PD"THENS="PAYMENT DUE-"
 65 F=INT(L/100):G=INT(F/12.1):D=L-100*F:Y=Y1+G
   :M=F-12*G:MK=M:YK=Y+1900:IFMK<3THENMK=MK+12
   :YK=YK-1
 70 N=YK+D+1+2*MK+INT((MK+1)*3/5)+INT(YK/4)
:E=INT(N-7*INT(N/7)):U="+"+MID$(T,E*3+1,3)+"-"
 75 IFH=1THENLPRINTUSINGV;M,D,Y;:LPRINTU;S;R
90 PRINTUSINGV;M,D,Y;:PRINTU;S;R:S="":R="":
   :IFL=LOTHEN05ELSEIFJ<0THEN50ELSEPRINT0936,;
   :INPUT"HIT =ENTER= TO GO ON";Q:CLS:PRINT,W
   :J=1:GOTO50
 05 INPUT NEW SCAN (Y/N) ;0:IFQ="Y"THEN15ELSEENO I00 ' * LINES 101-6031: NOTES FOR 5 YRS *
                     Program Listing 2
```

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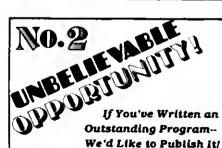
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"The collection must be sufficiently valuable to warrant computer management."

be formatted; with a colon seperator however, fields can be displayed es separate lines and, beyond the first line, with an indent. In this way, different aspects of a collection ere highlighted.

The Scott catalog system is the most common one in the United Stetes. Unfortunately a Scott number consists of a numeral with one or more prefixed letters. The prefix denotes the stemp type (regular

end commemorative issues have no prefix). This difficulty is resolved by the use of numeric offsets. For example, the first airmail stamp of any country has the Scott number C1; its record is stored against line 4401, that is, one plus the offset of 4400. The prefix/offset system established by lines 6002Q-60030 is adequate for the stamps of the United Stetes and most countries of the British area of

0 CLS:GOTO60000 60000 PRINTTAB(0) "STAMP HOLDING" :PRINT, "PROGRAM - A.J. & A.D. BARNARD" :PRINT:CLEAR300:DEFINTF-K, H-N :DEFSTRP-W,Y:DINT(44),N(44)
60010 S="(OWNER)-(NH/DD/YY)-(COUNTRY)->
:P1="(1)":P2="(4)" 60020 FORI-0TO44:READT(I),H(I):NEXT :DATA"*,0,AR,4000,B,4200,C,4400,CB,5400, CE,5500,CO,5600,E,5700,EO,5000,F,5900, FA,6000, J,6100, JQ,6500, K,6700, L,7000 LO,7300,N,7400,HB,7500,NC,7600,MO,7700, MR,7000,N,0000,NC,0400 60030 DATANE, 6500, NJ, 8600, NO. , 6700, NR, 8600, NRA, 6900, O, 9000, OY, 9500, P, 10000, PN, 10300, PR, 10400, Q, 10600, QE, 10700, RA, 10000, PR,10400,U,10000,UE,10700,RA,10000, RAC,10900,U,11000,UC,12000,UO,12100,UX, 13000,UXC,13100,UY,13200,UZ,13300,"",13400 60040 PRINTS;P1;" - ";P2:M=0:PRINT :INPUT SCAN SC # (WITH ANY PREFIX)";QF :INPUT TO # (WITH PREFIX)";QF=0*** :GOSUB60050:QF=QP:N1=N:QT=QL:QP= :GOSUB60050:QL=QP:N2=N:GOTO60060 60050 IFASC(LEFT\$(QT,1)) <= 64THENN=VAL(QT) :RETURNELSEQP=QP+LFTT\$(QT,1):QT=MID\$(QT,2)
:IFQT="THEN60200ELSEGOTO60050
60060 IFQF="w"ORQL="w"THENQF="u":QL="u" ELSEIFQF<>QLORN2<N1ORN1<0THEN60200 60070 FORI=0TO44: IFQF=T(I) THENN=M(I) :MX=H(I+1)-H-1:GOTO60080ELSENEXT:CLS :PRINT, "NO PREFIX ";QF:PRINT:GOTO60040 60000 IFN2>MXTHENCLS:PRINT,N2; BEYONO ;QF; RANGE :PRINT:GOTO60040ELSE W=QF+STR\$(N1)+" - "+QL+STR\$(N2) : N1=N1+N:N2=N2+N 60090 PRINT: INPUT PRINTOUT (Y/N) ;Q :IFQ="N"THENJ=0ELSEIFQ<>"Y"THEN60090 LSEJ=1:LPRINTS; W:LPRINT 60100 CLS:PRINTS; W:PRINT:F=0 :X=PEEK(16540)+256*PEEK(16549) 60110 L=PEEK(X+2)+256*PEEK(X+3):IFL<N1THEN60100 ELSEIFL>N2THENGOSUB60190:GOTO60040 ELSEG=0:RF="":R="":FORI=X+4TOX+255 :IFPEEK(I)>OTHENR=R+CHR\$(PEEK(I)):NEXT 60120 U=LEFT\$(R,1):IFU=CHR\$(32)ORU=CHR\$(39)OR U=CHR\$ (34) THENR=MID\$ (R, 2):GOTO60120 60130 FORI=ITOLEN(R):IFNIDS(R,I,1)=" THENG=G+1:RF=LEFTS(R,I-1):R=NIDS(R,I+1) ELSENEXT:RF=R:R="":G=G+1 60140 IFG=1THENY=QF+STR\$(L-N) ELSEIFG=2THENY=CHR\$ (LEN(Y)+192) 60150 F=F+1:1FF=9THENF=1:GOSU860190 :PRINTS; W:PRINT 60160 IFJ=1THENLPRINTY; " - "; RF 60170 PRINTY; - - *, RF:1FLEN(R) > 0THEN60120 60180 X=PEEK(X)+256*PEEK(X+1):GOTO60110 60190 PRINT@935,;:INPUT"HIT =ENTER= TO GO ON" ;Q:CLS:RETURN 60200 CLS:PRINT, "MISHATCH OR ERROR" :PRINT:GOTO60040

Program Listing 3

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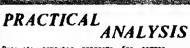
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"The Scott catalog system is the most common one in the United States."

specialty. If the number of offsets is eltered, a change must be made in the upper limit of the For. . . Next loops in lines 60020 and 60070 end in the Dimension statement in 60020.

Since the progrem is tightly packed and without remerks, explanation is needed. The PEEK routine of Program Listing 1 is incorporated into lines 60100, 60110 and 60180.

By line 60000 space is cleared for strings (the amount can be decreased if no record exceeds 100 characters), integer and string veriables are defined to speed execution and conserve memory. String S in

line 60010 must be personelized by owner's name, country, and date of file entry or update. This string serves as a heeding for a printout (line 60090). The intormetion is important for security or estate purposes. Scott numbers encompassed by the file are entered as P1 and P2.

Line 60040 displays the file heading end prompts entry of the renge of stamps to be scenned, and with line 60050 separates each entry into its alphabetic prefix and numerel. (Line 60060 converts a prefix W to U; collectors of postal stationery will appreciate this feature.) A check for entry errors is then made.

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4400 "LINES 4401-5399 AIRMAIL 4401 "U P LT CANC 4492 "U F:FFC(PULTON->NY12X25) ST 4403 "5 M F LH:4 U CDS 4406 "M F NH:6A SS M F:6B 11.5/11FERF U F FLT 4407 "9 (NO 8A) M F LH: 8A BID\$85 STOLON U P 15X180 4418 "M F LH:CVR PO CANC 4411 "M P NH TINY CR 4412 "U ON PC F 3 MGNS:U ON FCD G "15 M F LH:U F+:FDC SET ADDR F 4413 4416 *M VG MISS PERF: ZEP CVR(FULTN->BERLN) F APPEAR 4417 *13 M G LH CR: TBECH PR M HH: 17A BLU U VG 4419 "N VF:BLK6 N F:U F TINY TH 4420 "N P NH: POLK4 M F NH: FDC PR UNADOR F: 20A INPERF U F

Program Listing 4

JOHN ADAMS-12/15/80-W. AMERICA-> SC C1-C20

1 - U P LT CANC

2 - U F

- FFC (FULTON->NY12X25) ST

3 - 5 F LH - 4 U COS

6 - M F NH

- 4 U COS

- 6A SS N F

- 6B 11.5/11PERF U F FLT 7 - 9(NO 8A) M F LH

- 8A BIDS85 STOLOW U P 15X188

10 - M P LB

- CVR PD CANC 11 - M F NH T1NY CR

12 - U ON PC P 3 NGNS - U ON PCD G

13 - 15 M P LH

- U P+

- PDC SET ADDR F

16 - M VG MISS PERP

- ZEP CVR(FULTON-BERLN) P APPEAR

17 - 18 M G LH CR

- TBECH PR M G HH

- 17A ØLU U VG

19 - M VF

- BLK6 M F

- U P TINY TN

20 - M F NH

- POLK4 M P NH

- FDC PR UNADOR P

- 20A IMPERP U F

Program Listing 5

By line 60070, the entered prefix for the scan range is compared with the array of offsets; the proper numerical offset is found and added to the numerals. Line 60080 checks if the upper limit of the range exceeds the assigned number of lines for a given stamp type; if not, the scan limits are placed in string W for a heading.

A retrieved record is placed by line 60110 in string R and analyzed by lines 60120 and 60130, introductory spaces or single or double quotation marks are stripped. A check is then made for a colon in the resulting string: if one is found, the string to that point is placed in RF and the remainder left

Flag G is set in line 60110. If a colon is . found, G is incremented by line 60130. Line 60140 places the Scott number corresponding to the current line number into string Y(G = 1) for the initial display line for the record. For further lines, Y is a string of spaces equal to the number of characters in the Scott number.

The heading is displayed by line 60150 and the retrieved records by line 60170. When the counter F (lines 60100 and 60150) for the displayed record lines exceeds 10, Enter must be pressed (line 60190) for the next frame

Line 60170 checks if the entire record has been printed; if not, the program returns to line 60120 for further analysis and printing of additional fields.

If a printout is requested (line 60090), flag J is set and the LPRINT statements of line 60090 (headings S and W) and 60150 (retrieved record) are executed. (If a line printer is not used, delete this feature.)

Use of this program is exemplified by Program Listings 4 and 5. Listing 4 is a contrived program file for airmail stamps of an imaginary country. Listing 5 presents a typical heading and the printout for this file. Stamp collectors will be familiar with the tricks used to compact records: wellaccepted abbreviations, listing of sets versus single stamps, appending minor varieties that carry suffixed letters, etc.

The offset system can be extended to revenue stamps (e.g., with line numbers 20000 on). Secondary stamp-issuing entities can be included by added offsets; for example, the U.S. administration of the Philippines could be given the non-Scott prefix PHI.

This article has focused on the usefulness of Basic program files in the microcomputer management of small data bases with cassette storage. Program files effectively pack data and have special merit with loosely formatted records and where values for a significant parameter can be encoded as line numbers.

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Is anybody there...does anybody care?

Adventures in Modemland

Fred Biechman 7217 Bernadine Ave. Canoga Park, CA 91307

In Part I of "Adventures in Modemland" I described how I got my TRS-80 connected to my telephone using the Microconnection modem from The Microperipheral Corp. Now I could communicate with microcomputer bulletin boards all around the country. Assuming I could only contact other TRS-80s I looked over a list of 133 bulletin boards from The Microperipheral Corp. and found several that looked TRS-80 oriented: Forum-80, Comm-80, Info-80, Hobbiest-80 and Engineer-80. The closest was Fullerton, CA—the Comm-80 bulletin board of the Orange County TRS-80 Users Group (OCTUG).

I reduced my equipment to the bare bones for modem operation. The Microconnection was ribbon-cabled directly to the TRS-80 keyboard card edge. My parallel printer and Exetron stringy/floppy tape storage unit, normally connected to the keyboard, were disconnected. I didn't want any interaction to create problems—I was confused enough alreedy. See Fig. 1 for the minimum configuration.

Modem Encounter of The First Kind

I plugged in the Microconnection wall transformer, and made sure the telephone was connected. I loaded the S80 software program (provided with the Microconnection) into the TRS-80 using the cassette recorder. When the screen asked tor (H)alf or (F)ull Duplex command, I typed in F. The screen went blank except for a cursor in the upper left corner. I put the Microconnection modem in the Simplex/Data mode, and random characters (created by the diel-tone) and line noise appeared on the

screen. When I pressed a key thet character appeared on the screen; this meant my modem wes ready. I put the modem switches in the Duplex/Voice position, picked up the phone handset end dialed the OCTUG Comm-80 phone number, (714-528-3687). It answered almost immediately with a click and e steady tone.

I quickly set the Microconnection to the Duplex/Data mode. This transmitted a cerrier of the proper frequency to the modem at the other end of the line, letting the Comm-80 system know i was in contact. I hung up the telephone handset end contact confinued through the modem. After a couple of Enters from my keyboard, the Comm-80 started asking questions.

When OCTUG Talks, I Listen!

I had no experience with bulletin boards and no instructions of any sort. I just muddled through the questions, giving the best answers I could think of. The first question (Do You Need Linefeeds, Indicate yes or no"?) I answered no. Then the screen gave a basic description of the system. It asked my first neme, last name, and location. It repeated my inputs on the screen and asked for confirmation. The screen showed I was being logged onto Comm-80, with the date, time and caller number. When asked If this was my first time on the system, I enswered yes. I was then asked if I wanted more Information on the system; i replied yes and was told that Comm-80 is running on a TRS-80 with 48K. two MTi/MPI disk drives, TRSDOS 2.2, e Radio Shack RS-232-C, Centronics Micro P1 printer, a Novation CAT modem, autoanswer hardware from Computer Control. and software from Faulk and Associates

This was followed by an invitation from OCTUG to use the system any time 24 hours e day, seven days a waek. A simple command menu was then printed:

E--Enter e Message K--XIII a Meessge H--Help, Reprint this Llat R--Retrieve a Message S—List summery of messages
O—Quick Summery (MSQ # & Subject)
W—Redisplay the Welcome Message

T-Terminate the Session

Confusion and Panic

Although all this was happening at only 300 baud—about 30 characters per second—many lines were short. This meant that one, two or three lines e second were being generated on the bottom of the screen, pushing old lines off the screen. Without my printer connected, I had to read (and try to understend) too quickly for comfort. So I entered e T from my keyboard to terminate the session. The screen showed "User Logged Off Comm-80," gave the date, time, and total time on system (in hours, minutes and seconds) and disconnected. I put the Microconnection in Duplex/Voice model to disconnect at my and.

I called Info-80 in Seattle, but got hung up in the system, so I disconnected. After a couple of Forum-80 calls I sterted to get the hang of it. I found I was able to read messages within various cetegories (misceilaneous, personal, commerciel, system bulletins) and I could enter messages of my own.

Non-Standardization

My confusion was caused mostly by the non-standardization among different systems. Various control keys end commends are used. The TRS-80 does not have a Control key; Instead you usa a combinetion of a latter key with an Up-Arrow, but not always. Some use Shift and Key or Down-Arrow and Key. Some just use the letter alone for control during receiving, but es a command when responding to a question. Without experimentation or documentation on a particular system, you can waste a lot of time (usually at longdistence rates). Command letters can be particularly confusing. To end e session, you might need a T to terminate, e B for bye, or e G for goodbye. Don't use en E for exit or end, since E usuelly means enter (for leeving a message). Sometimes a B means bullatins instead of bye. And G.

This is the second article by Fred Blechman about modems; the first was The Microconnection 80 Microcomputing, August 1981.

"...computer communication over phone lines is by standardized character code (300 baud ASCII)..."

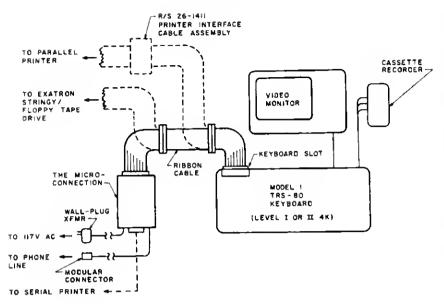


Fig. 1

Table 1 Typicel Apple Bulletin Board System Commands

Function:

(A, B, D, E, G, H, K, L, N, Q, R, S, T, V, W, X, ?) ?H 1

Enter your Choice:

'ALL' For Complete Review

'CTRL' For CTRL Characters, or

'A, B, D, E, G, H, K, L, N, Q, R, S, T, W, X, ?' for individual Response.

(C/R) to return to program

?ALL

Following is a brief list and description of the commands and their usage:

CTRL E-Retypes current line up to present position and allows you to continue from that point.

CTRL H (backspace)—Allows you to beckspace one character at a time and prints A '4' followed by the character you are backspacing over. This is the same routine as is used for delete or rubout instead of true delete. (For the benefit of printers)

CTRL U (forward arrow)—Starts you back at the beginning of the current line being typed (i.e. start over).

(C/R) to continue, (E) to end?

A—Apple 40 column. Normally you would be allowed 64 characters per line. A bell will sound at 59 and on up to 64 columns at which point you would be forced on to the next line of text. In the Apple 40 mode, the bell will ring at 35, then agein at 38 and 39, dropping you to the next line at 39. To avoid an extra blank line because of the 40th character, 39 was used instead of 40.

B-Print bulletin. Prints bulletins at beginning of progrem.

(C/R) to continue, (E) to end?

D—Duplex Switch. Alternately selects full or half duplex operation and informs you of current status.

Teble continues

used for goodbye on some systems, is used for graphics on Forum-80. Also, the same letter can have entirely different meanings as sub-commends within a single system.

Adding the Printer and Stringy/Floppy

With a few contects under my belt, I decided to add the printer so I could have a printout of what was happening on the screen. I have an Okidata Microline-80 printer with a Centronics-compatible parallel interface, so I'm eble to use a Radio Shack Printer Interface Ceble (#26-1411) without modification.

Since I don't have an expansion interface and the Microconnection was already plugged onto the card edge at the left rear of the keyboard. I used a two-for-one bus extender from Exatron. This is a five-inch long 40-wire ribbon cable with a 40-pin male card-edge connector on one end, a 40-pin female card-edge connector on the other end, and a 40-pin male card-edge in the center. This allows you to connect two 40-pin cables to the keyboard in parallel. I connected both the printer interface cable and the Microconnection cable to the keyboard using a bus extender. To use the printer with the S80 software, press the Shift, Up-Arrow and P keys at the same time. To stop printing, press the Shift, Up-Arrow and S keys at the same time.

Next, using another two-in-one bus extender, I added the Exatron String/Floppy tape storage unit. I made a copy of S80 on a String/Floppy wafer, and it loads the S80 program in a few seconds. The system, with printer, Stringy/Floppy and Microconnection connected parallel to the keyboard, worked just fine. No crosstalk or interference has been noted even after several months of operation.

Talking to an Apple

I noticed several bulletin boards listed that were local phone calls—but they were all lieted as ABBS. (Apple Bulletin Boerd System). I knew an Apple used a different Besic than a TRS-80, end that the screen on e standard Apple computer showed only 40 characters on a line, although the TRS-80 had 64 character lines. I dialed the Canoga Park ABBS at (213) 340-0135. Everything worked perfectly; I have since found that computer communication over the phone lines is by standardized character code (300-baud ASCII) using standardized frequency-shift keying (Bell 103), so eny computers using these standards can talk to each other-Apple, PET, TRS-80, OSI,

My first session with the Canoga Park system yielded a four-foot long printout in

Table continued

E—Enter message. Allows you to enter a message into system. Enter commands are basically self explanatory. A carriage return (C/R) at this point will list out the command menu for entries. The change command allows you to change an entire line but not just change part of it. Make sure when you are done with the message to save it to disc with the 'S' command.

(C/R) to continue, (E) to end? G—Goodbye. Exit program.

H-Help. Prints this routine.

K—Kill a message. Enter this to delete a message from the file. A password may be necessary if one was used at the time of message entry.

L—Line feed on/off. Normally on. For terminals that need en extra linefeed character to advance to the next line.

(C/R) to continue, (E) to end?

N—Nulls. Adds an extra delay after a carriage return to allow printers time to move the printerhead back to starting position. This option only works with the line feed option on. Each null is equivalent to 30 milliseconds delay and is adjustable from 1 to 30. It defaults to one.

Q-Quick scan. An abbreviated scan See 'S'.

R—Retrieve messages. Allows you to retrieve a message from the file.

(C/R) to continue, (E) to end?

Table continues

seven minutes and six seconds—and that included the time I spent scratching my head trying to figure out what to do next! Now I had the command and control codes for a typical ABBS system. (See Teble 1 for main commands and control characters.) Additional sub-commands are described during specific functions if you hit Enter instead of entering a command.

I called enother local system—the Woodland Hills ABBS at (213) 346-1849. This system included an autometic log-on function and a Chat mode. Typing a Cas a command alerted the system owners (If they were available) who could use their Apple keyboard to send a message in real time; I'd answer from my keyboard. It's like RTTY (radio teletype) but uses the video screens instead of printers.

A Visit to the Big Apple

Since this system was located only a few miles away, I made an appointment to see it in operation. I couldn't believe how simple it was: An Apple II with 48K RAM, two disks, a 12-inch video monitor and a D.C. Hayes auto-answer modem are connected to a standard telephone. When it rings, the auto-answer modem triggers the computer. The disk-based program was purchased for about \$40 from Rainbow Computing in August 1980. No user's guide is necessary, since the program is self-doc-



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Assembly language ISAM facility! Interfaces with 9ASIC. Very fast access to records in large files. Access/insert times 1-4 seconds.

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LPSPOOL — Add multi-tasking to permit concurrent printing while running your application program. The spooler and despooler obtain print jobs from queues maintained by the system as print files are generated. LPSPOOL supports both parallel and serial printers.

BASIC LINK FACILITY 'BLINK' (Mod I Min 32K 1-disk) Med I \$25; Med II \$50; Med III \$30

Link from one 9ASIC program to another saving all variables! The new program can be smaller or larger than the original program in memory. The chained program may either replace the original program, or can be **merged** by statement number. The statement number where the chained program execution is to begin may be specified!

INFINITE BASIC (Mod I & Mod III Tape or Oisk) Mod I \$50; Mod III \$60

Extends Level II BASIC with complete MATRIX functions and 50 more string functions. Includes RACET machine language sorts! Sort 1000 elements in 9 seconds!! Select only functions you want to optimize memory usage.

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includes RACET machine language SUPERZAP, Apparat Disassembler, and Model II interface to the Microsott 'Editor Assembler Plus' software package including uploading services and patches for Disk 1/0. Purchase price includes complete copy of Editor Assembler + and documentation for Mod I. Assemble directly into memory, MACRO facility, save all or portions of source to disk, dynamic debug facility (ZBUG), extended editor commands.

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8

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"Prepare to communicate with giants like The Source and CompuServe."

Table continued

S-Summerize messages. Allows you to scan over messages sterting at the message N you specify.

T-Time and date. Gives you the current time and date. This is also used automatically during log-in.

W-Welcome. Prints welcome message at beginning of program.

X-Expert user. Does awey with certain explanatory messages during the progrem. It also allows certain C/R*defaults. Ex: A C/R in response to functions? will print functions supported by the system.

-Prints functions supported in that current mode of operation.

is self-documented and prompts the user.

Forum-80

While there are many bulletin board systems you can use with a TRS-80, the most widely available system designed with the TRS-80 user in mind—and using a TRS-80 as the host computer-is the Forum-80. Bill Abney, the father of Forum-80, spent two years writing the combination Basic and machine language programe. If you have an interest in setting up a builetin board system, the current 3.1 version is available for a one-time license fee of \$150, which includes free technical

A minimum Forum-80 bulletin board system requires a TRS-80 with 48K RAM, three 35-treck disk drives, an RS-232 board

and an auto-answer modem. You can call Abney from 5 p.m. to 10 p.m. EST weekdays, or 10 a.m. to 7 p.m. weekends (818) 921-9439 for further information.

You can use a Forum-80 system by following the screen prompts and using the Help command. However, the system offers sophisticated features and many commands and sub-commands that can save you a lot of time and make your contact more efficient. To encourage proper utilization of Forum-80 systems, Abney distributes free user's guldes, in two volumes. Volume I is the basic system and Volume II covers the more advanced features. For copies send a selfaddressed, stamped, legel size envelope for each volume.

Postege is 28 cents for Volume I and 41

cents for Volume II. Mail to user's guide. Forum-80 Headquarters, 7600 East 48th Terrace, Kansas City, MO 64129.

Bulletin Board Rostar

There are at least 200 bulletin board systems on line around the United States. Some lists have been published previously (80 Microcomputing, May 1980, page 110, and Kilobaud Microcomputing, October 1980, page 158) but the picture keeps changing. The most extensive list I know of is offered free; send a self-addressed stamped envelope to The Microperipheral Corporation, P.O. Box 529, Mercer Island. WA 98040-(206) 454-3303.

What Good Ara The BBs?

You might wonder why you should get excited about using a computer bulletin board when a phone call or letter might be more efficient. Consider this: You and your computer are in the forefront of a new technological explosion in the information and communications fields. Bulletin boards are a training ground for developing new communication techniques. Also, some allow programs to be uploaded (from your computer memory to the host computer memory) or down-loaded (from the host computer to your computer memory) in various languages. As this sophistication proceeds, so will your ability to use your equipment and knowledge. Furthermore, bulletin boards prepere you to communicate with glant Information systems like The Source and CompuServe.

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What do I get?

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The ULTIMATE TRS-80 Terminal Package

do for the computer you mant to work with. The package includes six programs, seven data files, and real documentation: a 75-page manual that has been called "the best in the industry." And OMNITEAM comes with real user support. We can be reached via CompuServe, Source, phone, or mail to promptly answer your questions about using CHRITERM

What do I need to use OMNITERM?

A Model 1 or Model 111 TRS-80, at least 32K of memory, one disk, and the RS-232 interface OMNITERM works with all ROMs and DOSes, and will work mith your special keyboard drivers.

What will it do?

OMNITERM allows you to translate any character going to any device: printer, screen, disk, keyboard, or communications line, giving you complete control and allowing you to redefine the character sets of all devices. It will let you transfer data, and run your printer while connected for a record of everything that happens. OMNITERM can reformat your screen so that 80, 32, or 40 column lines are easy to read and look neat on your TRS-80 screen. It even lets you get on remote computers with just one keystrokel The program lets you send special characters, echo characters, count UART priors, configure your UART, send True Breaks and use lower case. It accepts VIDEOTEX codes. giving you full cursor control. It will even let you review text that has scrolled off the screen! Best of all, OMNITERM will save a special file with all your changes so you

can quickly use OMRITERM for any one of many different computers by loading the proper tile. It's easy to use Since it's menu driver, and gives you a full status display so you can examine and chance everything

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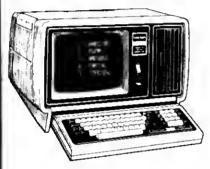
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Upon program initialization, the user specifies the item number and description digit length. This allows for item numbers up to 23 alpha-numeric characters. (As item number digits increase, digits for description usage are decreased.)

The program is completely menudriven, Items can be added, edited or deleted from the file. Items can be placed on order, received to stock, or sold from inventory. Complete printout capabilities are available through the printout menu.

Item information includes: item number, description, supplier, re-order point, cost, wholesale and retail selling price, quantity, on-order, and total sold. The re-order point is calculated by the program, based on number of items sold over a period of time. The time period is established at program initialization.

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Sunrise...Sunset

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Would you like to know the time of sunrise end sunset without having to look it up in the delly newspaper? The tollowing program finds the declination of the sun, the equation of time (the difference between apparent end mean time), the compass direction of the sun et sunrise and sunset, and the time of sunrise and sunset for any point in the continental United States.

If you ere interested in these values for only your own location, the program can be simplified by replacing the statements before line 210 with statements giving the values of LA—your lefitude in degrees and tenths, end TD—the time difference between sun time and stenderd time for your location.

The declination D and the equation of time E are approximated by finite Fourier series

in terms of X, the week number and fraction of the week, in lines 280 and 340. The value .04 in lines 530 end 560 is a correction for the refraction of light in the earth's afmosphere at sunrise and sunset.

I have found this program to agree within two minutes with the times of sunrise and sunset given in the local newspaper.

Progrem Listing

```
19 PRINT*THIS PROGRAM FINDS THE DECLINATION OF THE SUN, THE EQUATION*
20 PRINT*OF TIME, THE ALIMUTH ANGLES OF SUNRISE AND SUNSET, AND THE*
39 PAINT*TIMES OF SUNRISE AND SUNSET FOR ANY POINT IN THE CONTINENTAL*
40 PRIST*ONITED STATES.*
100 DIN H(12)
110 PL=3.14159/26: J=57.29578
129 IMPUT*ENTER LATITUDE (DEG.,MIN.)*,DI,M1
130 LA-MIHH1/60
149 IMPUT*ENTER LONG (B.C.M.P)*,TS
160 IF TS-"8" THEN LO-99: GOTO 218
161 IF TS-"8" THEN LO-99: GOTO 218
170 IF TS-"8" THEN LO-120: GOTO 218
170 IF TS-"8" THEN LO-120: GOTO 218
171 IT S-"8" THEN LO-120: GOTO 218
172 IMPUT*ENTER HONTH MO., DAY DF MONTH*;M,DA
172 IMPUT*ENTER HONTH MO., DAY DF MONTH*;M,DA
173 IMPUT*ENTER HONTH MO., DAY DF MONTH*;M,DA
174 IMPUT*ENTER HONTH MO., DAY DF MONTH*;M,DA
175 DATA 181,212,243,273,394,334
176 N=(M(M)+DA)/7
177 DATA 181,212,243,273,394,334
177 DESTIN(PL-X)+.868*SIN(2*PL*X)-.156*CO8(3*PL*X)+3.
180 PRINT
180 PRINT*DECLINATION OF SUN;",
180 PRINT*DECREES*
180 PRINT*DEGREES*
180 PRINT*DEGREES*
180 PRINT*DEGREES*
180 PRINT*DEGREES*
180 PRINT*DEGREES*
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Fat City

David D. Busch 515 E. Highland Ave. Revenna, OH 44266

etting your computer keep track of the meat in your home freezer can save frostbitten fingers and energy lost to escaped cold air. Better yet, firm control over what you have and don't have can keep you from accidentally dipping into the latest meat stocks while an older cut languishes at the bottom of the steck.

Freezer inventory was written to take some of the confusion out of stocking and maintaining meat in a home freezer. Some homeowners use log books which are difficult to maintain, never up-to-date, and time-consuming. It's usually necessary to do a physical inventory once each six months or so just to be sure of what's hidden in dark recesses of the freezer.

Others stock and replenish by the seat of their pants, knowing veguely how much ground beef remains, and trequently allowing choice cuts to succumb to freezer burn or some other malady because they were kept two or three years beyond the recommended freezer life.

Featurea

Freezer Inventory is a diskbased meat inventory system written for the TRS-80 Model I or III. Type, cut, weight and date frozen for up to 50 pieces of meat can be entered and stored. Depending on memory available, the number of items in the inventory can be increased.

In accessing the data, the user can see a list of all the foods in the freezer or scan the available cuts of only one type of meat. Nervous types can also retrieve inventory items by age. The program presents a list of all meats that were frozen one to six months prior to the current date.

Meats can be entered in one of seven different categories: pork, beef, lamb, fowl, ham, fish and other. Those who normally do not eat a certain type of meat for religious or other reasons can delete that selection(s) from the list. On the other hand, it rattlesnake, game or goat is part of your menu, it can be added.

Thirteen different cuts can be entered to further differentiate the item in the meat inventory. I put together the list to conform to the cuts we most frequently buy in our household: three kinds of roasts, three kinds of steak, chops, and other configurations such as ground. Again, these may be altered by the user.

To initialize the program, the data file must be created. This can most easily be done by

typing DIM FOOD\$(50,4) in the command mode, and then typing GOTO 1420. The program will open the file Foods, and save the available data (nothing, at this point) to the disk. Then, a File Not Found error will be avoided when the program is first run.

Data on the different meat types and cots are Read into two string arrays, Type\$(n) and Cut\$(n), at the beginning of the program. Next, the user is confronted with a menu, which presents six options:

- See list of all foods in the freezer.
- See list of only one type of food in the freezer.
- Add new foods to freezer inventory.
- · See list of foods by age.
- Save information input this session to disk.
- Remove an item from inventory.

Entering New Food Data

Depending on the option selected, control branches to a series of subroutines. Foods are added to the new or existing list as a subroutine at lines 730–1030. The meat data are stored within the program in e two-dimensional string array, FOOD\$ (row, column). The first row used, NF, indicates the number of foods in the file, and is incremented by one each time a new food is entered.

To simplify printing out options, code numbers instead of the actual names of the types of meat and cuts are stored in the array. The code number points to the element of TYPE\$(n) and CUT\$(n) appropriate to the item.

The first column of FOOD\$ (row, column) stores a number from one to seven, which stands for the name of the meat represented by that element of the string array Type\$(n). For example, TYPE\$(1) = PORK, so if a cut of pork were to be entered, a string containing the numeral "1" would be inserted in FOOD\$(NF,1).

The second column stores a string representation of the number that points to the CUT\$(n) element equivalent to the cut selected. Chops would be the fourth element of CUT\$(n), so to indicate pork chops, FOOD\$(NF,2) would contain a four.

The third column contains the actual weight of the cut, input by the user to the nearest half pound. Because the weight is stored as a string, the user can enter a number only, such as a four, or the words four pounds. The numeral must come first, as the program looks for the VAL of FOOD\$(n,3) when deleting a food from the list.

The date the food was frozen is entered into the fourth column (FOOD\$(NF,4)). The format

MM/DD/YY must be used. That is, Aug. 4, 1981, should be entered as 08/04/81. No error trap is built in to catch improper input, and fellure to conform to the standard MM/DD/YY will make it difficult to delete an inventory item tater.

Entering new foods is fairly tast. Each of the TYPE\$(n) and CUT\$(n) options is presented to the screen in a pair of For... Next loops at lines 830-850 and lines 920-940 respectively. INKEY\$ input will refuse any values other than those offered. Next, the user can input the weight of the meat. Weights to the closest pound are suggested, because of the needless complexity of converting pounds and ounces to decimal values. If two identical cuts of meat are entered on the same day, the user should enter slightly different weights to differentiate them. One could be four pounds, and the other 4.5

pounds. Mark these working weights on the package of frozen meat so the correct weight can be entered when the Item is deleted from the inventory.

After the date is input, control reverts back to lines 770-800, where the information entered is transferred to the correct element of FOOD\$(row, column). Then, the program returns to the menu.

You should remember to save current data to disk before exiting the program. By not having Save as an eutomatic step following the input of each new Item of food, some time is saved whenever several items must be entered at one time. This will frequently be the case after a shopping trip, or when freezing a newly purchased side of meat.

In eddition, e list of the current foods in inventory, including the new entries, can be requested—prior to the Save. If a mistake is discovered in the new entries, the user can delete the error (using menu option six) before the data is saved. Only one disk I/O operation need be performed at the end of the session.

Saving is performed et lines 1420-1490. The number of foods (NF) is first Printed to the disk file Foods, and then each element of FOOD\$(row,column) is recorded. Because the disk I/O time difference is almost negligible between having the Row loop increment from one to 50 and from one to NF, I elected to use the former, simpler system for program clarity. Those who find it necessary to redimension FOOD\$(row,col) larger than 50 rows may want to switch to the latter technique.

Accessing the File

The food file may be ac-

cessed three different ways. In lines 250-270, all the foods in the file are displayed. A loop from one to NF repeats until all foods are listed to the CRT. Pauses are built in every 12 foods by a check in line 290 thet sends control to e welt subroutine at lines 400-430. If the loop counter (N4) can be evenly divided by 12(N4/12=INT(N4/12)), then the user must hit any key to see the rest of the list.

If only one type of meat is to be listed, a subroutine at lines 450-710 checks FOOD\$(N6,1) in line 590 to see if it matches the food type looked for (A\$). If so, then the meat listing is printed to the CRT screen (lines 660-710), and a counter (CU) that keeps track of when 12 items have been found and displeyed is incremented. The same wait subroutine is used.

Meeta may also be listed by age (lines 1050-1400). The user inputs the current date as a

Program Listing

```
16 CLEAR 1806
28 SLS="/"
     DIM TYPES(7), CUTS(13), FOODS(58,4)
GOSUB 1588
50 FOR N=1 TO 7: READ TYPES(N): NEXT N
50 FOR N=1 TO 7:READ TYPES(N):NEXT N
60 FOR N=1 X0 7:READ TYPES(N):NEXT N1
70 DATA PORK, BEEF, LAMB, FOWL, HAM, FISH, OTHER
80 DATA ROAST-ROAST-RUMP, ROAST-RIB, CHOP, STEAK-SIRLOIN, STEAK-CHUC
K, STEAK-ROUND, HHOLE, HALF, 0 REASTS, LEGS, CROUND, BRISKET
90 ' ****** MENU ******
188 CLS:PRINT:PRINT
118 PRINT " ENTER CHOICE :"
128 PRINT " 1,) SEE LIST OF ALL FOODS IN FREEZER"
138 PRINT " 2.) SEE LIST ONLY OF ONE TYPE FOOD IN FREEZER"
                                        3.) ADD NEW FOODS TO FREEZER INVENTORY"
4.) SEE LIST OF FOODS BY AGE"
5.) SAVE INFORMATION INPUT THIS SESSION TO DIS
 148 PRINT '
 160 PRINT
170 PRINT "
                                        6.) REMOVE AN ITEM FROM INVENTORY"
190 PRINT "--->";
200 AS=INKEYS:IF AS="" GOTO 208
200 A9-INRELIGIT GV-

210 A9-VAL(AS)

220 IF A<1 OR A>6 GOTO 200

230 ON A GOTO 240,440,720,1840,1410,1680

243 ' ****** LIST ALL FOODS IN FREEZER ******
 260 PRINT "TYPE", "CUT", "WEIGHT", "DATE"
272 PRINT
272 PRINT
280 FOR N4-1 TO NF
290 IP INT(N4/12)=N4/12 GOSUB 390
380 PRINT TYPES(VAL(FOODS(N4,11)),
316 PRINT CUTS(VAL(FOODS(N4,2))),
320 PRINT FOODS(N4,3),
338 PRINT FOODS(N4,4)
 340 NEXT N4
 350 PRINT
360 PRINT "HIT ANY KEY TO RETURN TO MENU"
370 IF INKEYS="" GOTO 370
380 GOTO 108
380 GOTO 100
390 PRINT
400 PRINT "HIT ANY KEY TO SEE REST OF LIST"
412 IF INKEYSS" GOTO 412
423 CLS:PRINT
 473 CUSTRIES
433 RETURN
444 ' ******* LIST ONLY ONE TYPE OF FOOD ******
 442 / ***** 452 CU=1
468 CLS:PRINT:PRINT
 470 FOR N5-1 TO 6
400 PRINT N5, ".) ";
490 PRINT TYPE$(N5)
 500 NEXT ES
 516 PRINT
520 PRINT "ENTER CHOICE";
530 AS=INKEYS:IF AS="" GOTO 530
```

```
540 A=VAL(A$)

550 IF A<1 OR A>6 GOTO 538

560 CLS:PRINT:PRINT

570 PRINT "ALL "!TYPE$(A);" LISTED BELOW:"

580 FOR N6=1 TO NF
588 FOR N6-1 TO NF
598 IF FOODS(N6,1)*AS THEN GOSUB 668
680 NEXT N6
610 PRINT
628 IP CU=1 THEN PRINT "NG ",TYPES(A);" FOUND IN FILE";PRINT
638 PRINT "HIT ANY KEY TO RETURN TO HEHU"
648 IF INKEYS-" GOTO 648
668 CU-CU+1
668 CU-CU+1
668 CU-CU+1
 678 IF INT(CU/12)=CU/12 COSUB 390
680 PRINT CUTS[VAL[FOODS(N6,2))),
690 PRINT FOODS(N6,3),
788 PRINT FOODS(N6,4)
           RETURN

****** ADD NEW FOODS TO FREEZER INVENTORY ******
 738 CLS:PRINT:PRINT
748 NF=NF+1
758 PRINT "FOOD TYPE OF NEW ENTRY:"
768 GOSUB 828
778 FOODS(NF,1)=AS
768 POODS(NF,2)=A2$
788 POODS(NF,2)=A2$
  790 FOOD$(NF,3) *A3$
800 FOOD$(NF,4) =A4$
  810 GOTO 100
816 GOIU 100

826 PRINT

830 FOR N2-1 TO 6

846 PRINT N2;" ; ";TYPES*N7'

850 NEXT N2

860 PRINT "ENTER CHOICE :";

878 AS-INKEYS:IF AS-"" GOTO 878

888 AEVAL(AS)
  880 A=VAL(AS)
890 IF A<1 OR A>6 GOTO 870
980 CLS
  910 PRINT
  928 FOR N3=1 TO 13
930 PRINT N3; ".) "; CUT$(N3)
   948 NEXT N3
 950 PRINT
960 PRINT "ENTER CUT OR TYPE :";
978 INPUT A25
988 A2=VAL(A25)
998 IF A240 OR A2>13 GOTO 978
1600 CLS:PRINT:PRINT
1818 INPUT "ENTER WEIGHT TO CLOSEST POUND :";A35
1828 IMPUT "ENTER WEIGHT TO MM/DD/YY]";A45
   950 PRINT
  1838 RETURN
1848 ' ****** SEE LIST OF FOODS BY AGE *****
   1858 CLS:PRINT:PRINT
1868 INPUT "ENTER TODAY'S DATE : (MM/DD/YY) ";DATES
1878 Y15=RIGHTS(DATES,2)
   1888 M1S=LEFTS(DATES,2)
```

Program continues

Program continued " 1890 Y1=VAL(Y1S) 1108 M1-VAL(M15) 1116 CLS:PRINT:PRINT 1128 FOR N7=1 TO 6 1130 TYS=Y15 1130 THEN 1-N7 1150 IP TM<1 THEN TM-TM+12:TY=Y1-1:TY\$*STRS(TY) 1160 PRINT 1170 PRINT "ALL FOODS ";N7;" MONTHS OLD LISTED BELOW" 1180 PRINT 1190 PRINT TYPE , "CUT", "WEIGHT", "DATE" 1210 CU=1 1220 FOR N8=1 TO NF 1228 FOR N8=1 TO NF 1238 YS=RIGHTS[FOODS(N8,4),2) 1240 MS=LEPTS(FOODS(N8,4),2) 1258 IP VAL(YS)=VAL(TTS) AND VAL(MS)=TM THEN COSUB 1348 1269 MEXT N8 1278 PRINT "HIT ANY KEY FOR REST OF LIST" 1288 AS=INKEXS:IF AS="" GOTO 1280 1298 CLS:PRINT 1369 NEXT N7 1310 PRINT "HIT ENTER TO RETURN TO NEHU" 1320 IF INKEYS="" GOTO 1328 1338 COTO 186 1348 CUT=CU+1 1348 CU=CU+1 1368 PE CU/12=INT(CU/12) GOSUB 398 1368 PRINT TYPES[VAL(FOODS(N8,1))) 1378 PRINT CUTS(VAL(FOODS(N8,2))), 1388 PRINT FOODS(N8,3), 1398 PRINT FOODS(N8,4) 390 PRINT FOODS TO DISK ****** 1428 OPEN "O",1,"FOODS" 1438 PRINT \$1,NP 1448 POR ROW=1 TO 50 1450 FOR COL=1 TO 4 1460 PRINT 41. POODS(ROW.COL) . ". ": 1478 REXT COL,ROW 1480 CLOSE 1 1490 COTO 188 1598 ***** LOAD POODS PROM DISK ***** 1510 OPEN "I",1,"FOODS" 1520 INPUT #1,NF 1528 POR ROW=1 TO 50 1538 POR ROW=1 TO 50 1548 POR COL=1 TO 4 1558 INPUT #1,FOOD\$(ROW,COL) 1568 NEXT COL,ROW 1578 CLOSE 1 1588 RETURN 1590 ****** REMOVE FOOD FROM INVENTORY ****** 1600 CLS:PRINT:PRINT 1610 PRINT "ENTER DATA ABOUT 1TEM REMOVED FROM INVENTORY:" 1618 GOSUB 828 1618 FOR N9=1 TO NF 1648 IF VAL(FOODS(N9,1))=VAL(AS) GOSUB 1678 1658 NEXT N9 1668 GOTO 100 1678 IF VAL(FOOD\$(N9,2))=VAL(A2\$) AND VAL(FOOD\$(N9,3))=VAL(A3\$) GOTO 1698 1688 RETURN 1098 IF POOD\$(N9,4)<>A4\$ THEN RETURN 1788 IF N9=NP THEN NF=NF-1:PETURN 1718 FOR M=1 TO 4 1728 FOOD\$(N9,M)=POOD\$(NF,M) 1750 RETURN

MM/DD/YY string, which is parsed, and the values of the MM and YY compared with the values of the corresponding segments of each of the dates of the foods in the file. Target years (TY\$) and terget months (TM\$) are determined for each of six months before the current month (lines 1130-1140). If a target month carries back into the previous year, then the value of TY\$ is decremented by one, and the target month adjusted accordingly (line 1150). The loop prints out lists of meats one to six months old, month by month.

Deleting an Item from the File

As foods are consumed, they must be deleted from the file. This is accomplished by a routine at 1600-1750. The user enters data about the item to be removed (type, cut, weight and date frozen), and each element of FOOD\$(row,column) is examined until a match is found. If the item to be deleted happens to be the last item in the file, (N9 = NF) in line 1700), then NF is decremented by one, making that row in FOOD\$ (row.column) available for new entries (which will wipe out the old ones, if still present). Effectively, the old entry does not exist, because loops accessing the data will not go beyond NF in their search.

More frequently, however,

the item deleted will not be the last element of the array. Usually the oldest cuts of meat are consumed first. In this case, the item is deleted by taking the last set of data in the array, and moving it to the spot to be vacated. Then, NF is decremented by one. Effectively, this closes up the array by putting the last entry into the hole left by the last one deleted.

Enhancementa

Freezer Inventory offers a number of opportunities for enhancement. Additional meet types and cuts can be tacked on by redimensioning the array TYPE\$(n) and CUT\$(n), and by enlarging the loops which display these choices to the user tor input or retrieval. Use Step 2 to count off the display loops two numbers at a time, and change print lines, as in line 840 to read: 840 PRINT N2;".)": TYPE\$(N2),N2 + 1;".)"; TYPE\$(N2 + 1). This will allow displaying a greater number of choices on the screen at one time without scrolling off.

Frozen vegetables could also be added with a little Imagination. Vegetable could be given as element 0 of TYPE\$(n), and whenever FOOD\$(row,1) was equal to zero then column 2 (cut) would be ignored, and, instead, a vegetable type would be input or retrieved from a new column in the array.

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(9) CBASIC-2, a non-interactive BASIC used for many programs that run under CP/M, allows user to make more efficient use of disk files, eliminates the use of most time number references ...require on such programs as the BELECTOR \$120

(10) MICROSOFT BASIC, an anhanced version of the MICROSOFT BASIC bound on TRSOOS adds commands such as chaining fallows the user to LOAD and RUN a new program without losing the variables currently in memory, long variable length tile records. WHILE/WEND and others can be used with the BASIC COMPILER to speed up programs (3-10) times faster execution). \$325

(11) MASTER TAX (CPAIds) professional tax preparation program prepares schedules, A. B. C. O. E. F. G. R/RP, S.E. T.C. ES and forms 2106, 2119, 2210, 3488–3903, 2441, 4625, 4726, 4797, 4972, 5895 and 5521 Printing can be on readily available pre-printed continuous forms, on overlays, or on computer generated IRS approved forms Menians clinin history files.

(12) GENERAL LEDGER II (CPAIds) designed for CPA's stores complete 12 month detailed history of transactions generates financial statements, depreciation, loan amortizations, journals, trial balances, statements of changes in financial position, and compilation letters includes payroll system with automating posting to general ledgers prints payroll register, W2's and payroll checks \$450

(13) ELECTRIC PENCIL (Michael Shreyer Software) Complete word processor with extensive editing and printer formattling features \$275 (Standard printer version) \$300 (DIABLO, NEC or OUME

(14) BASIC COMPILER (Microsoft) changes your source programs into machine language increases program execution by 3-10 times \$395

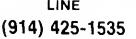
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1 RULE 78 Interest Apportionment by Rule of the 78's 2 ANNUI Annuity computation program 3 DATE Time between dates 4 DAYYEAR Day of year a particular date falls on 5 LEASEINT Interest rate on lease 6 BREAKEVN 7 DEPRSE 8 DEPRSY 9 DEPROB 10 DEPRODB 11 TAXOEP 12 CHECK2 13 CHECKBK1 14 MORTGAGE/A 15 MULTMON 16 SALVAGE

Breakeven anatysis Straightline depreciation Sum of the digits depreciation Declining balance depreciation Double declining balance depreciation Cash flow vs. depreciation tables Prints NEBS checks along with daily register Checkbook maintenance program Mortgage amortization table Computes time needed for money to double, triple, etc. Determines salvage value of an investment

17 RRVARIN Rate of return on investment with variable inflows 18 RRCONST Rate of return on investment with constant inflows 19 EFFECT Effective interest rate of a loan 20 FVAL Future value of an investment (compound interest) 21 PVAL Present value of a future amount 22 LOANPAY 23 REGWITH Amount of payment on a loan Equal withdrawals from investment to leave 0 over

24 SIMPDISK Simple discount analysis 25 DATEVAL Equivalent & nonequivalent dated values for obig 26 ANNUDEF 27 MARKUP Present value of deferred annuities

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Constructs seasonal quantity indices for company Time senes analysis linear trend

Time senes analysis moving average trend Future piece estimation with inflation Mailing list system.

Letter writing system links with MAILPAC Sorts list of names Shipping label maker Name label maker

DOME business bookkeeping system Computes weeks total hours from timeclock info-In memory accounts payable system storage permitted Generate invoice on screen and print on printer

In memory inventory control system Computerzed telephone directory

Time use analysis Use of assignment algorithm for optimal job assign. In memory accounts receivable system-storage ok-

Compares 3 methods of repayment of loans Computes gross pay required for given net Computes seiling price for given after tax arriount Arbitrage computations

Sinlung fund depreciation Finds UPS zones from zip code Types envelope including return address Automobile expense analysis

Insurance policy file In memory payroll system Dilution analysis Loan amount a borrower can afford

Purchase price for rental property Sale leaseback analysis

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- 2. Each of the S.B.S.G. Business Modules may be purchased separately.. or you may purchase the entire coordinated business system.
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- Footproof, Step-By-Step procedures are supplied, planned and documented for the First-Time Computer User. All programs are selfexplanatory, telling the user what is required at every step
- 5. Programs are written in BASIC and the source code listing is supplied for those users who decide to modify the original system
- 6. A complete users manual is supplied with each module
- 7 Demo Data diskettes are supplied with sample data.
- 8 S.B.S.G. has an In-House staff that can answer questions and problems related to the proper use of the S.B.S.G. Business System (on the telephone or through the mail)
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- 10 Minimum system requirement is 2-drives to run any single module.
- 11 Minimum system requirement is 3-drives to run the coordinated business system (AR-AP-GL) or (AR-AP-GL with PAYROLE).
- 12 Minimum system requirement is 4-drives to run the extended coordinated system (AR-AP-GL-PR and INVENTORY/INVOICING).
- 13. The A. OSBORNE & ASSOCIATES business manuals are provided FREE with each order (they may be purchased separately at \$20 per manual)
- 14 The INVENTORY and INVOICING modules are original programs written by \$.B.\$.G.
- 15. Each module can be purchased as independent modules to run on a 2 or more drive system except INVOICING
- 16. Memory requirement is 48K for the MODEL-II and 64K for the MODEL-II.
- 17 All S.B.S.G. BUSINESS SYSTEMS may be upgraded up to 4-disk drives. No data is ever lost during an upgrade. There is a standard S.B.S.G. charge for all upgrades

ACCOUNTS PAYABLE

The accounts payable system receives data concerning purchases from suppliers and produces checks in payment of outstanding invoices. In addition, it produces cash management reports. This system aids in tight financial control over all cash disbursements of the business Several reports are available and supply information needed for the analysis of payments, expenses, purchases and cash requirements. All A/P data feeds General Ledger so that data is entered into the system just once. These programs were developed 5 years ago for the Wang micro-computer and have been tested in many environments since. then. The package has been converted to the TRS-80" and is now well documented, on-line, interactive micro-computer system with the capabilities of (or exceeding many larger systems).

CAPABILITIES:

- menu driven; easy to use, full screen prompting and cursor control
 invoice oriented everything revolves around the invoice, handles
- new invoice or credit memo or debit memo invoice information recorded; invoice #, description, buyer, check register #, invoice date, age date, amount of invoice, discount (in %),
- freight, tax (\$), total payable transaction print and file maintenance procedures insure accuracy
- flexible check calculation procedure; allows checks to be calculated for a set of vendors-or-for specific vendors
- program prints your checks, contiguous computer checks with your company letterhead can be purchased from SBSG reports include (samples on back)
- - open item listing/closed item listing both detail and summary
 - debit memo listing/credit memo listing
- aging
 check register report (to give an audit trail of checks printed)
 vendor listing and vendor activity (activity of the whole year)
 tully linked to GENERAL LEOGER; each invoice can be distributed
- to as many as five (5) different GL accounts, system automatically posts to cash and A/P accounts

ACCOUNTS RECEIVABLE

The objective of a computerized A/R system is to prepare accurate and timeley monthly statements to credit customers. Management can generate information required to control the amount of credit extended and the collection of money owed in order to maximize profitable credit and the objection or library owed in order to maximize promains com-sales while minimizing losses from bad debts. The programs com-posing this system were developed 5 years ago, especially for small businesses using the Wang Microcomputer. They have been tested in many environments since then. Each module can be used stand alone or can feed General Ledger for a fully integrated system

CAPABILITIES:

- menu driven; easy to use, full screen prompting and cursor control
 invoice oriented; invoices can be entered before ready for billing,
- when ready for billing, after billing or after paid allows entry of new invoice, credit memo debit memo, or change/ delete invoice
- allows for progress payment
- transaction information includes

 type of A/R transaction
 - billing date customer P.O. # general ledger account number
 - description of P.O.
- Invoice amount
- shipping/transportation charges
- tax charges
- payment
- progress payment information
 transaction print & file maintenance procedures insure accuracy customer statements printed; computer statements with your compay letterhead can be purchased from SBSG
- reports include (samples on back)

 listing of invoices not yet billed
- open items (unpaid invoices)
- closed items (paid invoices)
- aging fully linked to General Ledger, will post to applicable accounts. debit A/R, credits account you specify

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PAYROLL

Payroll invoices many complex calculations and the production of reports and documents, many of which are required by government agencies. It is an ideal candidate for the computer. With this Payroll system in-house, you can promptly and accurately pay your employees and generate accruate documents/reports to management, employees. and appropriate government agencies concerning earnings, taxes, and other deductions. The package has been converted to the TRS-80* and is now a well documented, op-line, interactive, micro-computer system with the capabilities of (or exceeding) many larger systems.

CAPABILITIES:

- performs all necessary payroll tasks including
- tile maintenance, pay data entry and verification
 computation of pay and deduction amounts

- printing of reports and checks can handle salaried and hourly employees
- employees can receive.

 - · hourly or salary wage
 - vacation pay
 - noliday pay
 - piecework pay
- overtime pay
 employees can be paid using any combination of pay types (except, hourly cannot receive salary and salary cannot receive hourly) special non-taxable or taxable lump sums can be paid regularly or one time (bonus, reimbursements, etc)
- health and welfare deductions can be automatically calculated for
- each employee earnings-to-date are accumulated and added to permanent records; taxes are computed and deducted; US income tax, Social Security

- taxes are computed and deducted: US income tax, Social Security tax, state income tax, other deductions (regular or one time) paychecks are printed, computer checks with your company letterhead can be purchased from SBSG calculations are accumulated for; employee pay history, 941A report, W-2 report, insurance report, absentee report fully linked to General Ledger. Each employee's payroll information can be distributed to as many as (12) twelve different GL accounts;

INVENTORY CONTROL/INVOICING

system automatically posts to cash account

- ISAM (Indexed Sequential Access Method) eliminates the necessity for time consuming sort.
- Pre-Allocated Files for IMMEDIATE update and inquiry capabilities
- Fast Oisk storage and retrieval Inventory Master Record includes...class...SKU...Oivision...Retail Cost...Beginning Batance...Period Sale Units Period Receipts. On Order. On Hand...Minimum Reorder Point...Recommended Reorder Amount...Vendor Number...Period Sale Oollars ...YTO Sale Units...YTO Sale Oollars
- Units...YTO Sale Collars
 Calculated and Displayed Formulas include Gross Margin (\$)...
 Gross Margin (%)...Gross Margin ROI (%)...Average Inventory Retail
 (\$)...Average Inventory Cost (\$)...Turn-Over (%)
 Reports Generated include...Master File Listing Class Oescription
 Listing...Transaction Audit Trail...Minimum Reorder Point by Vendor...Retail Price Lisl...Retail & Cost Price Lisl...Period Sales Report
 ...Year to Cate Sales Report...Stock Status (Screen or printer output)
- ...Commission Report (for salesmen and buyers).
 Transaction Types include...Sales, Vendor Receipts...Vendor
 Orders...Customer Returns...Vendor Returns .Transfer Stock

GENERAL LEGGER

The General Ledger accounting system consolidates financial data from other accounting subsystems (A/R, A/P, Payroll, direct posting) in an accurate and timely manner. Major reports include the Income Statement and Balance Sheet and a "special" report designed by management. The beauty of this General Ledger system is that it is completely user formatted. You "customize" the account numbers, descriptions, and report formats to suit particular business requirements. These programs were developed 5 years ago for the Wang micro-computer and have been tested in many environments since then. The package has been converted to the TRS-80" and is now a well documented, online interactive micro-computer system with the capabilities of (or line, interactive micro-computer system with the capabilities of (or exceeding) many larger systems.

CAPABILITIES:

- more than 200 chart of accounts can be handled
- account number structure is user defined and controlled
- more than 1,750 transactions may be entered via:
 - direct posting; done by hand; validated against the account file before acceptance
 - external posting; generated by A/R, A/P, Payroll or any other user source
- * data is maintained and reported by:
 - month
 - quarter

 - year
 previous three quarters
- reports (samples on back) include:
 - trial halances
 - income statement
 - balance sheet
- special accounts reports and more....
 user formats reports with the following designated as you wish:
 - titles
 - headings
 - account numbers
 - descriptions
 - subtotals
 - totals
 - skip lines
 - skip pages
- up to eight levels of totals fully user designated
- menu driven; easy to use; full screen prompting and cursor control



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- * Step-by-step dissection of complete and useful routines to test memory and to gain direct control over the keyboard, video monitor, and printer
- * How to access and use powerful routines in your Level II ROM

This course was developed and recorded by Joseph E. Willis and is based on the successful series of courses he has taught at Meta Technologies Corporation, the Radio Shack Compuler Center, and other locations in Northern Ohio. The minimum system required is a Level II. 16K RAM

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- * A display program for each lesson to provide illustration and reinforcement for what you are hearing
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- * A diskette with machine-readable source codes for all programs discussed, in both Radio shack EDTASM and Macro formats
- * Routines to convert from one assembler formal to the other

This course was developed and recorded by Joseph E. Willis, for the student with experience in assembly language programming, it is an intermediate-to advanced-level course. Minimum hardware required is a Model I Level II 16K RAM one disk drive system

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Tweak six additional characters out of Radio Shack's generator chip.

Soft Characters

Stephen D. Moulton 766 Biltmore Drive Virginia Beach, VA 23454

eing a computer programmer both in profession and hobby, I was intrigued by a letter in 80 Input ("Lowercase Access", November, 1980). The letter concerned those who had Redio Shack's lowercase modification Installed, which included a brief program to POKE certain special characters into

10 CLS 20 FOR X = 32 to 191 30 PRINT CHR\$(32); CHR\$(X); 40 NEXT Program Listing video memory. The letter also stated that these characters were otherwise inaccessible to Basic. If you run that program, you will see that a lowercase @ remains @, while lowercase arrows and underline keys produce apaces (see Program Listing 1).

At this point it occurred to me thei, if the characters can be displayed with a series of POKE statements, they are obviously included in the Radio Shack hardware upgrade. The lack of accessibility to Basic must be caused by a deficiency in the software driver. I found

thet this is indeed the case, although I can not fethom why Radio Shack would deliberately ignore some of the capabilities of their character generator chip. At any rate, here is a fix for ULCBAS which will allow the display of six additional characters (£,{,⅓,},ψ,■) under Besic control. In addition, the fix will repair the defective automatic memory protection feature so that the two POKE statements recommended by Radio Shack need not be entered prior to the execution of the driver program.

First, load and execute T-BUG and load ULCBAS using the L function. Now use the M function to make the changes listed in Table 1. The first two locations changed will repair the automatic memory protection feature so thet your Basic program stack will not interfere with the driver softwere end cause a keyboard lockup. The remeining six changes add the additional characters to the driver program. Next, save the petched driver on tape using P 7000 7270 7000 ULC16K (this is the filename I use for my 16K system, but you can use eny filename that you find convenient). At this point, I would ... turn off the TRS-80 just to make sure that any gerbage I may have scattered through memory will be cleered, but a simple J 0000 should auffice.

To run the modified driver, first answer the memory size question with Enter (the program is self-protecting, right?). Next, type System, press Enter, type the filename you chose when you saved the program, and wait for the tepe to load. Answer the *? prompt with

Change Location	From	То
709D	50	F2
		70 for 16K system
709E	70	BD for 32K system
		FO for 48K system
7247	40	60
7262	20	7 8
7263	20	7C
7264	20	7D
7265	20	7 E
7266	20	7F



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- 5) The user can get an ALPHABETIZED directory from within scriplus.
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- 9) Works with MOD I and MOD III! (Including MOD III 3.1 Scripsit!)
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/Enter and the familiar Ready prompt will appear. You now have the lowercase driver in protected memory, and ?MEM will yield 15046. To view your new character set, run the Program Listing 1 again. See the difference?

Now that we can access the

additional characters from Basic, let us discuss how to use them in our programming. First, you will note that the @ key will always yield "@" when used alone and "£" when used with the shift key, regardless of the status of the Shift Otoggle. I did this to make the @ key function like the other dual-symbol keys at the top of the keyboard. I also did not incorporate keyboard reversal for this key because £ will not be used as frequently ea @ in normal programming applications. Note that the computer will not accept PRINT£ es PRINT@ (although the Exatron Stringy Floppy will accept £LOAD as @LOAD). Note also that Shift@ still functions to pause program

execution. The next four special characters can not be input from the keyboard because the shifted arrow keys serve control functions. These symbols must be displayed using ?CHR\$(123) through (126). The final symbol cannot be input from the keyboard because it is a shifted underline, and the TRS-80 has no underline key to shift! It can be displayed by ?CHR\$(127).

There remains one additional note for owners of the Exatron Stringy Floppy. The lowercase driver software must be loaded and executed prior to the In-Itialization of the ESF operating system (this applies to the original driver supplied by Radio Shack or to the one created in this article). After executing the driver program, the Stringy Floppy must be Initial-Ized using /12346 (not /12345) because the Exetron end lowercese driver debounce routines will interfere with one another.

So there you have it; 32 lower case characters for the price of 26!

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Crossdos

Jack Means 1612 East Oakland Bloomington, IL 61701

Digital Research's CPM is neither the most sophisticated nor the most convenient operating system available for the TRS-80. However, the large number of programming languages and quality business packages available for TRS-80 CPM made me more than willing to order it.

Immediately after receiving it, I was feced with two problems. First, the text editor provided with CPM (ED) was too limited end cumbersome to suit my needs. Second, I needed some way to transfer programs and data files from TRSDOS (or NEWDOS) to CPM.

A Solution

Program Listing 1 solves both problems. I can now creete a program under TRSDOS using virtually any text editor (Electric Pencil, Scripsit, Electric Secretary, even the TRS-80 Basic editor), and transfer the file to CPM using the attached progrem. In

addition, the program allows me to transfer any sequential data set from TRSDOS to CPM. The program can handle random files, but they must first be converted to sequential data sets.

To use the progrem, load the file and type "Run". The system will immediately display: Enter Input file name:.

At this point, enter the name of the TRSDOS file to be transferred. It the file is a Basic program created with the TRS-80 Basic editor, it must heve been saved with the ASCII option (i.e., SAVE "MAILLST/BAS",A). The next video display will be: Enter name for output CPM file:.

Enter the name which you would like to have assigned to the file after it is transferred to CPM. Remember, if you plan to use the file as input to the CBasic compiler, it must have the suffix of .BAS (i.e., MAILLST.BAS).

Enter CPM Drive (A,B,C,D) for output:

Enter the CPM drive name to which the output data set should be written. Remember thet CPM uses A, B, C, D instead of 1, 2, 3, 4.

The system will now display the word Converting: end

display each text line as It is read into the system. When the entire file has been read into

memory, the system will display something similar to the following:

File MAILLST/BAS has been written In memory. Please copy the following statements exactly;

M8000,875D,4300 SAVE 8 8:MAILLST. 8AS Press Enter when you have copied the statements.

Once the Enter key has been pressed, the screen will clear end the following will be displayed:

Remove all TRSDOS disks. Insert the CPM system disk in drive A. Insert a CPM formatted disk in drive е

Press Enter when the CPM disks are ready

At this point, remove all TRSDOS disks and place the CPM System disk in drive A (TRSDOS 0) and the disk for the output in the drive indicated. If the data set is to be written on the System disk, the second statement can be ignored.

Once the CPM disks have been loaded, press Enter. The CPM operating system will be loaded and the prompt A> will be displayed. At this point you should enter: DDT.

The system will then display the following: "-".

Next, enter the first of the two statements you copied earlier (i.e., M8000,875D,4300). The system will respond with:

Now press the Break key. This will cause the CPM to reboot. As soon as the A> prompt appears, enter the second of the two statements copied earlier (i.e., SAVE 8 B:MAILLST.BAS).

A copy of the transferred file is now in the drive specified. It can be edited by ED as if it had been created on the CPM system. However, the last line in the file will usually contain garbage. To eliminate the line simply use the ED kill (K) command.

As written, the system will transfer just over 32,000 bytes at a time. If your file is larger than this, it can be segmented and transmitted as individual files. Once on the CPM system, you can again merge the segments.

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So you're a new Model III owner—or you're thinking of getting a Model III. One thing you want to know is, "Are there a lot of progrems I can use?" The answer is an emphatic yes! The vast majority of Basic progrems written for the TRS-80 Model I will run without moditication on the Model III—but not all of them.

But first let's get some confusing terminology straight. Radlo Shack has chosen to use the TRS-80 name on all their recent computers (Model I, Model II, Model III, Model III, Pocket Computer, Color Computer and Videotex Terminal). However, the Basic interpreters for these computers are not the same; some programs require more memory than others; and some programs are written for disk-based systems, others strictly for cassette.

In both the Model I and the Model III the less-sophisticated Basic is called Level I. They seem to be 100 percent compatible, with the added feature Model III Level I includes—print-

er commands not found in Model I Level I.

Model I Level II Basic is largely compatible with Model III Basic. This Basic is not called Level II with the Model III, possibly to avoid confusion with Model II Basic which is quite different.

I have a cassette-based Model I Level II 16K unit for which I've written and sold various programs (Amway Producte Distributor programs and Small Home-Business programs). I also have 22 programs in a new Hayden book (Programs for Beginners on the TRS-80). Since all these programs were written for Model I, I wondered if they would run on Model III.

Reel Trouble

I bought the TRS-80 Model III Operation and Basic Language Reference Menual (Radio Shack Catalog Number 26-2112, \$5.95) and read it cover to cover. This convinced me the Model III is more then just a repackaging of the Model I, since it has so many additional features.

Since all my programs are in Level II Basic, I didn't concern myself with Level I, but looked for information on the programming compatibility with Model III Basic. In the 270-page Model III manual, less than one page is devoted to Model I to Model III conversion hints! What particularly grabbed my attention were the differences in available memory (less in Model III) and the slightly different character sets. I could see I was in trouble, but later found the trouble was worse than I thought. Many Level II Model III differences are not mentioned In the manual!

It became obvious that the only certain way to find out how my programs would operate with a Model III would be to run them on one. Armed with my Level II cassettes, my own recorder and a loading meter (to reduce tape loading problems), I went to the local Radio Shack Computer Center and explained my dilemma to the store manager. He could not have been more cooperative.

There were about six Model Is and six Model IIIs set up for their classroom, and he seid I could use them as long as I didn't interfere with his classes.

I found a 16K Model III Basic machine and immediately ran into the first thing not mentioned in the Model III manual. It seems Radio Shack recently changed the DIN five-pin plug on the cassette recorder-tocomputer cable from one with a thick plastic sleeve to one with a thin metal one. The old type plastic sleeve DIN plug will not fit the Model III socket! You must have the new Radio Shack cassette recorder cable, now supplied with the CTR-80A recorder also available separately (Catalog Number AW-2577 for \$6.95). The new cable fits both Model I and Model III.

The manager loaned me a new cable. We plugged everything in, turned on the Model III and "CASS?" appeared on the screen; this was the computer asking me what cassette speed to use. Model III Basic uses 500 band for data recording; 1500 or 500 baud for cassette program loading or saving. Since Level II uses 500 baud only and my cassettes were recorded in Level II, I typed and entered L for low cassette speed. The default value (pressing Enter without typing anything) will result in a high cassette speed and Level II tapes will not load!

The first program I tried was my "Amway Order Verification," which loads into about 10,400 bytes of memory; no problem—

until 1 tried to run it. While dimensioning a large array—something I had no problem doing with my Model I 16K—the Model III told me it was out of memory. Model III Basic has less available memory.

A Definite Lack

How much less? That depends on your Model I. The Model III has 258 bytes less user memory than the older versions of Model I Level II. 256 bytes less than leter versions. When you type and enter: ?MEM or PRINT MEM on the Model I, you get 15572 (older Model I) or 15570 (new Model I) for Level II 16K. On Model III 16K Basic you get 15314. This is the best way to determine no extra memory has been reserved for Clear, arrays or upper-memory programs. (Actually, 50 bytes are automatically cleared on power-up for string handling. To prove this, type and enter CLEARO and then ?MEM and you'll tind 15364 as the Model III Basic total free memory, but you won't be able to handle any strings at all. Type and enter CLEAR50 and you're back to power-up configuration.)

Fortunately in this program, the entire array was not really required. I reduced the array size and the order verification program ran beautifully. In another version of this program, which needed the maximum array size, I removed some remark lines to free enough memory.

A Mystery Revealed

Next I loaded my "Amway Monthly Gross Profit" program-plenty of memory to spare, no problem there. However, right at the beginning of the program I PEEKed at memory location 14312 to determine if the printer was ready. A number in this memory location indicates the printer status in the Model I. The printer status is at the same memory location in Model III Basic. Unfortunately, the value of the number at this memory location is not the same in the Model I and Model III.

The solution to this problem

is to PEEK at location 14312 with your printer on and ready and note the number for that particular printer. Be aware that different printers may give a different value at 14312—especially if you are using a serial printer with a printer-driver program in memory. The printer-ready number at 14312 can then be used by the program to determine if the printer is ready. If not, the program can branch around LPRINT commands.

Also, it's not generally known (and not in the TRS-80 menuals) that with Level II Basic you can punch in POKE16423,4 to make your program transparent to LPRINT statements. This also works with Model III Basic.

However, to restore program recognition of LPRINT, you must Insert POKE16423,5 for Model I or POKE16423.3 for Model III. Do not put in POKE16423,5 on the Model III or you will lock the computer in Disk Basic and will be able to recover only by turning the computer off (thus losing your program) and then turning It back on after 10 seconds while also pressing the Break key. I found this out from the store manager when I unintentionally locked the computer center's Model III in Disk Basic and thought I had destroyed it!

With Renewed Courage

Regaining my courage, I loaded and ran five other Amway programs and found no other changes necessary. Then I turned to the Small Home-Business Package designed for Level II 16K with printer. The first program, "Speed-Letter," a simple text generator, bombed out with the message ?OM ER-ROR in 130. Line 130 of that program is CLEAR9400, to preserve lots of string space for text. The fewer bytes of free memory in Model III Basic caused this to happen, so I changed line 130 to CLEAR9000 to reduce the memory requirement. Thie allowed it to run in Model III Basic, but also reduced the length of text permitted in using the program.

That program also uses an





PROBASIC

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- Loader relocatably links user specified modules to save memory.
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- Dump teature allows you to save your versions of Basic
- Sample: PROBASIC -P: ACDEFGIM -S:Your file

Probasic includes the following relocatable modules

PRO - ANGLES

OEGREES, RADIANS ASIN, ACOS, PI #

PRO-LABELS

- Label branching & testing
- IF LABEL 85 < > "Tast" THEN MERGE . 85 "Test" PRINT "Test"

PRO-EXTENSIONS

- Dynamiciy save variables & files during editing, merging, linking & deleting, ...
- New RENUM
- New MERGE, LINK

PRO-WORDS

UPC\$, LWC\$, TRIM\$, REV\$, PAUSE, RPT\$ FCHR, FSTR. FSECT\$, CHG\$, EVAL, CKKEY, FRACT, COMP. FOTY, MIN, MAX, EDT\$, E #, INV\$, CNSEC\$,

PRO-EDIT

- Immediata entry keys
- ♦ ♦ ◆ ▼ , ./†1
- New LIST & EDIT ROLLUP, ROLLON

PRO-SORT

- String aray sort routines
- 2000 strings in 7-16 sec SORTe\$("USING 1,2...)

PRO-FUNCTIONS

- Multi-line Functions
- MID\$ TO
- WAIT for \$ reorganizing
- New-HEXS
- Misc fixes

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PRO-DEBUG

- Most breckets optional . . .
- Fix T M arror
- New DELETE
- TRSTEP, TRVAR, PROC, INSERT, DIR, INBSC

PRO-KEYS

- Redefine key(s) to any string from progrem or keyboard Enable/Diseble from keyboard with CTR'L -)
- Fix live keyboard
- PROKEY = , PROKEY\$

PRO-MACH

S V C axcess to basic subs New - BREAK (Reset) PEEK, PEEK%, PEEK\$, POKE, POKE%, POKE\$, CALL edras (parms). CLATH, EXECUTE, INP.

PRO - CRT

Inverse vidio CRT, CRT\$, SCROLL

PRO - FILES

Fix - LOF

RELOC, OPEN "E"

PRO - VRS

- Allows 3 letter veriables
- Reserved words in variables UPCVRS, LWCVRS

KEYVRS, VARLEN

PRO-GRAPH

Draw lines, patterns, points SET, RESET, POINT, USING, TO, GRAPH

319-233-6111

text. The Model III video display character set is not identical to tha Modal I. In particular, there are 96 special additional charactars, but no up, down, left or right arrows! It seems incredibla these were not included in the new 96 characters. The up arrow on the Model I keyboard produced an up arrow on the screen. This could also be generatad using the command CHR\$(91). The Model III keyboard still has an up arrow, but this key (or CHR\$(91)) produces a left bracket instead of an up arrow. I didn't change my program but instead, tolerate a left bracket instead of an up arrow on the acreen. This could really be a problem in a program that usad arrows to indicate direction, such as some game pro-

up arrow to indicate the end of

Another Program Bombs

grams.

My "12-Column Ledgar" and "3-Across Mailing Labels" programs loaded and ran with no changes.

However, I ran into two Model III Basic problems with my "Telephone Dialer/Timer" program. This program automatically dials a telaphone, using up to 500 names and phone numbers stored in memory. The dialing is accomplished by using the internal TRS-80 relay to trigger an external buffar relay whose contacts interrupt the phone circuit. The recorder cable subminiatura plug (which normally goes to the recorder ramote jack) is directly connacted to the internal TRS-80 relay contacts. The OUT255,4 command on the Model I closes this relay's contacts, and OUT255,0 is used to open the relay contacts. This does not work on the Model III, so I got help from the manager again. Ha end the Computer Center laad technician went through soma Model III schematics and fold me to try OUT236,2 to close the ralay and OUT236,0 to opan it. It worked!

The timing portion of this program, used to show elapsed time in seconds and minutas for cost calculation, was running too tast. The Model III runs et 2.02752 MHz, while the Model I runs at 1,774 MHz. Consequently, any For...Naxt loops used for timing nead to be modified. Unfortunately, although the Model III internal clock speed is approximately 14.3 percent fastar than the Model I, the Basic speed of operation is not directly related by the sama percentage. In this program I found a FOR X = 1 TO 266:NEXT loop had to be changed to FOR X=1 TO 285:NEXT (only a sevan percent increase in counts) to retain one second for a completed loop count. It becomes a matter of trial and error and will vary with individual machines and room temperature. The circuits are crystal controlled, with no real attampt at extreme accuracy or long-term temperature stability, so don't expect your TRS-80 timing loops to have even the accuracy of your digital wristwatch.

I ran into the same thing in my "Talaphone Toil-Charge" program, where a similar For...Next loop count had to be increased from 263 to 325 (an almost 24 percent increase in counts) to maintain a nominal one-second completed loop. Several things affect the running speed of For... Next loops: the location of the loop within the program; whether the variable is an integer, single or double precision; and to some degree, the number of other variables that pracede this loop variable in the program.

Next, I decided to see how tha 22 programs I wrote for the Hayden book would run in Model III Basic. Most of these programs were originally written in Lavel I 4K Basic, then changed to Level II. Since the book faaturas line-by-line axplanations of each program, I wantad to see if any rawriting would be necessary. I found that axcapt for the numbers in some timing loops, no other program changes were necessary. So, Model III runs many simple Model i progrems with little or no change.

Tha book also contains several appendices, and I checked their validity for Model III flasic. A two-line keyboard debounce program, needed in

Level II to prevent multiple entries when pressing a key only once, is not needed for the Model III, since the keyboard does not have this problem. My Audio/Visual Control Box, for reliably loading cassette programs and controlling recorder operation, worked perfectly with the Model III without any changes. Simple subroutines for printing the screen display on a printer, with and without graphics, worked perfectly. But I ran into trouble using a simple two-line Besic program merging technique.

Another Discovery

The Model III manual memory map (page 12/23 of the operation section) shows 17129 as the beginning of user memory. However, decimal memory locations 16548 and 16549 are the beginning-of-program pointer. The numbers in these two locations are the least and most significant bits, in decimal form, of an eight-digit byte giving the decimal location of the beginning of the Basic program area.

For Model I Level II, focation 16548 shows a 233 and location 16549 has a 66. Multiply 66 by 256 and add 233 and you get 17129. However, the Model III on power-up shows a 67 in location 16549 and 233 in 16548. Since 67 times 256 plus 233 equals 17385, it seems the beginning of Basic programs is 17365—exactly 256 bytes higher than in the Model I.

Apparently this is where the Model III lost 256 bytes. I confirmed this with some PEEKs at e Basic program in memory and by successfully merging progrems using the technique in the book, revised to reflect the new beginning-of-program location.

While you may wonder if this is important, I can tell you this change will reise havoc with any System tapes you have that load into low memory. There are various utility programs that do this. They won't work unless modified and for most of them this means "back to the drawing board," since they are written in machine language, not Besic.

Another item in my book eppendix needed revision. I have a one-liner that makes two cassette copies with a two-second gep between them. I put this at the end of all my programs as the last line:

CSAVE"1":OUT255,4:FOR I=1 TO 2000:NEXT:CSAVE"1"

See the problem? OUT255,4 must be changed to OUT236,2 for Model III. With this as the last program line, you merely type run line number and Enter and the computer dumps two copies on tape.

One of my programs uses a

WEB International T-Beep, a device that beeps on command from the computer. This tells you when the computer has finished a task (sort, search, loed, save or a program error). It uses a simple command and time-loop for operation from the cassette auxiliary cable. The command OUT255,1 causes the voltage at the computer's gray miniature phone plug to go from its normal .45 volts do to .9 volts do. This is enough to make the T-Beep sound. The command OUT 255,0 returns the voltage to .45

volts. I checked this out on the Model III and these commands have not been changed.

There are many other subtle differences between Level II and Model III Basic in various ROM eddresses that can crash your progrems written for Level II in mechine code. Also, Basic POKEs and PEEKs will heve to be carefully checked. If your Level II program crashes in Model III—especially with a ?CASS or the memory size query on the screen—you probably POKEd into the wrong locetion.

Difference	Level II Basic 16K	Model III Basic 16K
assette Cable *	Plastic DIN Plug	Metal DIN Plug (R/S#AW-2577)
Less Memory 56 or 258 Bytes)	?MEM = 15772 or 15770	7MEM = 15364
Printer Stetus*	?PEEK (14312)	?PEEK (14312)
Same Location, Different Value)	(Note Value)	(Note Value)
LPRINT*	POKE 16423,4 to Disable	POKE 16423,4 to Disable
	POKE 16423,5 to Enable	POKE 16423,3 to Enable
CHR\$(91)	†	1
Arrows	t • • -	None
Speed	1,774 MHz	2.02752 MHz
(Timing Loops)		
Internal	Out 255,4 to Close	Out 236,2 to Close
Relay*	Out 255,0 to Open	Out 236,0 to Open
Geginning of Gesic Program*	17129 (42E9 Hex)	17385 (43E9 Hex)
"Not covered (or in	correct!) in Model III manual.	

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ne of the best features of Basic programming is that once you become good at it, there are more conquests to make as you discover new methods to use so your programs look neater, execute fester, and use less memory space. We will exemine some

tricks that will halp you round off those rough edges.

It never occurs to most programmars that data statamants can exist in harmony on multiple statement lines. The Modal I owner's manual gives the impression that data lines should be tucked away by themsalvas at the bottom of the program. But, both of these lines are valid:

10 DATA 23,25,89,100: FORX-1 to 4: READ A(X): NEXT 10 FORX = 1 to 4: READ A(X): NEXT: DATA 23,25,89,100

Don't hold back on the length of multiple attement lines, pack them full. Multiple statements save bytas and dacraase program run time.

```
18 CLS
28 PRINT@256, "<A>DD":PRINT"<R>EPORT":PRINT"<D>ELETE":PRINT"<S>ET
UP"
38 AS-INKEY$;IFA$="A"THEN168ELSEIFA$="R"THENRUN"REPORT/BAS"ELSEI
FA$="D"THENRUN"DELETE/BAS"ELSEIFA$="S"THENGOTO289
48 FORX=1TO56:NEXT:GOSUB68:FORX=1TO168:NEXT:GOSUB78
59 GOTO38
68 PRINT@257, "A";:PRINT@321, "R";:PRINT@385, "D";:PRINT@449, "S";:R
ETURN
78 FRINT@257," ";:PRINT@321," ";:PRINT@385," ";:PRINT@449," ";:R
ETURN
```

Progrem Listing 1.

```
10 ONERRORGOTO100:DEFUSR=123456
20 REM
OTHER INSTRUCTIONS GO HERE
FOR DISK
80 GOTO200
100 POKE16526,L. S. B. :POKE16527,N. S. B.
OTHER INSTRUCTIONS GO HERE
FOR TAPE
200 ONERRORGOTO0:REM
PROGRAM STARTS HERE
210 X=USR(Q)
```

Program Listing 2.

Program Listing 1 ahowa e sampla menu. An option is to be salactad. Check out lina 30—it's packed, but very afficiant. The book didn't tall you that it's possible to usa more than one If ... Than ... Else statement on a lina, but you can use as many as you want. Just keep track so each If hes a Than, and an Elsa If needed.

Thara are two other intarasting points to be made ebout that short program in Listing 1. First, if some options ara selected, program execution may branch to another section within the program (by using GOTOs), or it may run an entirely different program, All tha command words listed in chaptar two in your Lavel II owner's manual can be used. Tha only exception is CONT: It's not that the machine doesn't recognize that word, it lust doesn't know what to continua.

Soma commands don't raturn you to your Basic program after thay axacuta, such as CLOAD, List and Systam.

Experiment daleting lines or aven causing New to execute if the operator indicates ha's done with this program.

The second point of interest is dynamic flashing of the characters to be selected. As you can see, the progrem prompts you to raspond with A, R, D or S. Between chacking the kayboard via INKEY\$, these latters are blinked on and off. Since the Model I doesn't have a flashing cursor, this animeted input lets the operator know that the com-

puter is ready and awaiting further instructions.

Potpourri

You can use a PEEK statement as the value part of a POKE statement. This line takes the character on the upper-most left side of the screen and displays it near the center of the screen:

10 POKE 15850, PEEK (15360)

Variables with a daclaration character after them may or may not be the sama as the plain veriabla. For example, if you use the variable SR%, don't expect SR to have the same value. We've run into trouble assuming that the two would always be aqual.

Auto Date Routine

If you have a program which uses the current day's date within it, put the auto date check routine at the top of Program Listing 4. The routine determines if the date has been set. If the date has not been set, it will ask you to Enter the date. Should the date already be set, then it will display the date and ask is Data O.K.? Execute these lines before a clear statement in your program so none of the variables here will interfare with those used later on.

The routina simply PEEKs the address whera tha day is stored. If the value there is zero, the data has not been sat.

The For . . . Next Trick

Check out Program Listing 3. Sea tha NEXT A in lines 50, 60, 70, 80, and 100? You could rewrite the program by changing all of those NEXT As to GOTO 20 and delete line 10. But the program as it stends takes up fewer bytes than would the GOTO version even with that extra line deleted!

This method is a convenient way of returning to the same point in a program. Perhaps the returned point could set up something on the screen, or reset some variable. By stepping zero, the loop never runs out of counts.

The For... Next Step 0 technique is not necessarily a great advantage over GOTOs and GOSUBs, but it does use less memory.

A Disk Basic Trick

Here's a trick for Disk Basic programmers. We had a program where we were cramped for disk epace and each byte wes important. The program must store many detes, both the month and the day. The trick is to take the dates and menipulate them so they take up less disk space.

Since there is no need to store a slash (I), just create one number from the two. Then you can use MKI\$ and store the number as an integer. Upon retrieving the number, do the reverse. Add a slash and split the number in two. This saves bytes over storing the date in its entered form:

10 INPUT"ENTER MONTH AND OAY (MM/OO) ":DA\$
20 OA = VAL(LEFT\$.2) = HIGHT\$(DA.2))
30 LSET(fleid variable) = MXI\$(OA)

To restore: 10 B\$ = STR\$(CVk(fleid variable)) 2 0 B\$ = MiO\$.(B\$1,2) + "f" + RiGHT\$(B\$,2)

Game Tips

30 PRINT B\$

When writing a game or a children's program which utilizes an INKEY\$, use a dummy INKEY just prior to the one you want. This picks up any stray keys that may have been pressed before you want a response from the operator. Here's how it could be set up:

10 IK\$ = INKEY\$
20 PRINT"SELECT A LETTER"

30 A\$ = INKEY\$: IF A\$ = ""THEN 30 40 -----PROGRAM TEXT-----

The variable IK\$ will never be used enywhere in the program. It simply prevents previous key entries from getting through to line 30, where the real variable, A\$, is quizzed. Let's go one step better than INKEY\$ for getting input from the operator.

By PEEKing memory location 15350, you can find a value returned by the keyboard. This method has two adventages over INKEY\$. A\$ = INKEY\$ won't hold the value if it is in a loop. The next time that statement is hit, A\$ would change to become whatever is there.

Also, PEEK will detect if more than one key is being depressed. This is great for checking to see if the arrows are being held down. The up arrow 16, left arrow 32, and the right arrow 64. If you hit the left and up arrows together, the memory location holds a 40, which is the addition of 32 and eight. Furthermore, holding down e key will enable you to design continuous firing into your game.

The negative aspect of this procedure is that we're only looking at one byte of the keyboard return, so other keys will return the same value. Both the left arrow and the letter T, for example, return a value of 32

but it generally serves the purpose for most games.

Disk and Level it USR Calls

Our final tip deals with the use of the USR commend. Writing a program with a USR call can get you into trouble if you want it competible with both Level II and Disk Basic. Since Disk Basic supports more than one USR call, it must be set up a little differently. If the program has only one USR call, an error handling routine can trap it and branch program execution to an appropriate section.

To tell the computer where to go when a USR cell is encountered, Disk Basic requires the eddress to be set up by DEFUSR-address. Level II Basic has the eddress value POKEd into memory locations 16526 (least significant byte) and 16527 (most significant byte).

A DEFUSR statement would give an L3 error if it were run under Level II. Take a look at Program Listing 2. If this was run in Level II, line 10 would generate an error but because of the On Error statement the program won't go out on error, but rather will branch to line 100 where it can be set up for Level II operation. Similarly, if run in Disk Basic, execution would continue to line 20.

- 10 FORA=1TO2 STEP0
- $20 \ x = x + 1$
- 3Ø B=B+1
- 40 C=C+1
- 50 IFX=100 PRINT"X=100":X=0:NEXTX
- 60 IFB=250 PRINT"B=250":B=0:NEXTX
- 70 IFC=3 PRINT"C=3":NEXTX
- 00 PRINTA
- 90 NEXTX

Program Listing 3.

Program Listing 4.

. .

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The program is structured on the classic decision grid concept. This management tool facilitates decision making when a problem has many conflicting elements. The real value of Cadet is that it allows you to concentrate on identifying the issues end your feelings about them. The program takes care of the mathematics and even calculates a level of confidence for the suggestion it makes so you have some idea of how sure you can be about its advice.

The program also provides some cheerful graphics to keep

your spirits high while your mind contemplates the issues. When you run the program, for example, you will see an animeted spirel that simulates the "thinking" process of a RAM chip.

The action comes from lines 907 to 909. For some interesting variations on this theme, type in the following short program:

0 CLS 10 R = 3 20 FOR X = 0 to 375 step 7 30 G = R*7*SIN(X) + 71 40 C = R*3*COS(X) + 20 50 SET(6,C) 80 R = R-.05 70 NEXT X 80 GOTO 80

This is the same spiral pattern that appears in the program. Now try changing the 375 in line 20 to 850 and decrease the step size to 5: you get a pretty flower spiral.

Lines 30 end 40 plot the sine and cosine values of X using polar coordinates. The factors of 7 end 3 in these same lines are needed to compensate because the pixel (picture element) on your screen is not square; it is a rectangle with an end to side ratio of 3:7. If you start experimenting with these numbers, you will get an eliptical spiral instead of the circuler one.

The numbers added et the ends of lines 30 and 40 are there to position the design on the CRT. It is best to keep the center of the design near the middle of your screen since an illegal function error results when the equation attempts to plot points off the video.

There ere meny modifications you can make in this program. By changing the values, often only slightly, you can create some fascinating graphics. After all, now that Cadet has solved your problems, you should have plenty of time to create fantastic graphics.

Program Listing

90 REM 95 PRINT"FOR EXAMPLE, A 'I' WOULD INDICATE THAT THE FACTOR IS N

TOO SIGNIFICANT, ": PRINT" A '9' WOULD BE USED FOR THOSE ITEMS YOU

Program continues

CONSIDER REALLY

Program continued (STATEMENTS NOT PRECEDED BY AN 'F' OR 'A' OR ENDING WIT A VALUEFROM 1 TO 9 WILL BE VOIDED. THEY SHOULD BE RE-ENTERED. INK
SHOULD BE CONSIDERED. WHEN YOU ARE THROUGH, SIMPLY TYPE
'N' IN RESPONSE TO THE QUESTION: 'ANY HORE PACTORS I
SHOULD CONSIDER?': PRINT
IIS PRINT! WILL THEN REVIEW WITH YOU ALL THE FACTORS YOU HAVE I
DENTIFIED." 120 PRINT AFTERWARDS, I WILL GIVE YOU BY SUGGESTED DECISION WHIC H
WILL BE LOGICALLY DERIVED FROM YOUR OWN VALUES.*

125 PRINT*FINALLY, I WILL GIVE YOU A CONFIDENCE LEVEL FOR THE
DECISION I SUGGEST, "; PRINT
130 PRINTTAB(48) "PRESS / KEY."

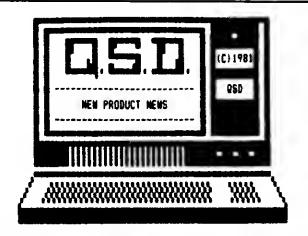
131 PINKEYS.>*/"THEN13IELSECLS
135 PRINT*THE QUESTION 16: "; 22.8

148 PRINT*PRINT*PLEASE BEGIN NOW TO ENTER THE STATEMENTS FOR AND
AGAINST 148 PRINT:PRINT:PLEASE DEGIN NO. -AGAINST
THE PROPOSED ACTION. (DON'T PORGET TO PUT AN 'F' OR 'A' BEFORE
EVERY STATEMENT AND A NUMBER FROM 1 TO 9 APTER EACH GNE.)*
141 PRINT:PRINT: F -OR- A STATEMENT

"TO 9" 141 PRINT:PRINT" F -OR- A

1 TO 9*
12 PRINTSTRIRGS(64,*-*):NO-1:MU-6:NU±8
145 IRPUTAS[1]:GOSUB246:GOSUB259
155 INPUTAS[2]:GOSUB246:GOSUB256:GOSUB256
155 INPUTAS[3]:GOSUB246:GOSUB256
166 INPUTAS[3]:GOSUB246:GOSUB256
178 INPUTAS[3]:GOSUB246:GOSUB256
178 INPUTAS[4]:GOSUB246:GOSUB256
178 INPUTAS[6]:GOSUB246:GOSUB256
189 INPUTAS[7]:GOSUB246:GOSUB256
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199 INPUTAS[7]:GOSUB246:GOSUB256
199 INPUTAS[7]:GOSUB246:GOSUB256
199 INPUTAS[7]:GOSUB246:GOSUB256
199 INPUTAS[7]:GOSUB246:GOSUB256
199 INPUTAS[7]:GOSUB246:GOSUB258
199 INPUTAS[7]:GOSUB246:GOSUB258 210 INPUTAS(14):GOSUB246:GOSUB250 215 INPUTAS(15):GOSUB246:GOSUB250 220 INPUTAS(16):COSUB246:GOSUB250 225 INPUTAS(17): GOSUB246: GOSUB258 238 INPUTAS(18): GOSUB246: GOSUB258 235 INPUTAS(18): GOSUB246: GOSUB258 248 INPUTAS(28): GOSUB246: GOSUB258 245 PRINT: PRINT THAT MAKES 20 STATEMENTS WHICH IS ALL I CAN HAND AT ONE TIME. LET ME PROCESS THESE AND SEE WHAT KIND OF DECISION 1 REACH. ":FOR T=1T04986:NEXT:CLS:GOT0254 246 MU=Hd+1:NU=NU+I:FORX=MU TO NU:IF LEFT\${A\${X}},1}="P" OR LEFT\${A\${X}},1}="A" THEN 247 ELSEPRINT"RE-ENTER YOUR LAST STATEMENT AND PRECEDE IT WITH 'P' OR 'A',";:PRINT:A\${X}="A VOID STATEMENT 0" IRETURN
247 NR=VAL(RIGHTS(AS(X),1)): IP ABS(NR)> Ø AND ABS(NR)<10 THEN RET
URN ELSE PRINT*RE-ENTER THE LAST STATEMENT AND END IT WITH A VAL
UE PROM 1 - 9 -7: PRINT: AS(X) = "A VOID STATEMENT 6": RETURN
250 1 MPUT*ANY MORE QUESTIONS TO CONSIDER (Y/N) "; MS
251 1 FMS="Y"ORMS="N"THEN253 252 PRINT*PLEASE ANSWER ONLY 'Y' FOR YES OR 'N' FOR NO. ":GOTO258 253 IFMS="N"THEN254ELSENO=HO+1:RETURN 254 FOR X=1TO28
255 IF LEFTS(AS(X),1)="f"THEN SF=SF+VAL(RIGHTS(AS(X),1))ELSE SA= SA+VAL(RIGHTS[AS(X),1)) SA+VAL(RIGHTS[AS(X),1])
260 NEXT X
355 GOSUB765
360 PRINTP460, "YOU CAVE ME ";NO;" FACTORS TO CONSIDER.":PRINTP58
8, "THEY WERE : "::FORT=1TO2888:NEXT:CLS:NU=1
361 FORX=1TONO:FORS=15552TO15615STEP2:PORES,176:NEXT
362 FORS=16864TO16127STEP2:PORES,176:NEXT
365 PRINTP448,NU]*.1 ";NIOS(AS(X),2,LEN(AS(X))-2):NU=NU+1
370 FORT=1TO2888:NEXT:CLS:NEXTX
465 PRINTP446, "PRES / REY TO CONTINUE."
466 IFINREYS<>"/"THEN466ELSECLS
478 PRINT:PRINT"APTER CAREFULLY ANALYZING ALL THE INFORMATION YO U MAVE U HAVE PROVIDED ON THE QUESTION: ":PRINT PROVIDED ON THE QUESTION: "IPRINT 475 PRINTIZE" 488 PRINTIF SESSA THENPRINT" RECOMMEND IN FAVOR OF THE PROPOSE D ACTION. ":GOTO 488 485 PRINT: IF SADSP THENPRINT' RECOMMEND AGAINST THE PROPOSED ACTION. GOTO 488
486 IF SF-SA THENPRINT' AN UNABLE TO SUGGEST AN ANSWER.
THE POSITIVE AND REGATIVE ELEMENTS IN THIS ISSUE BALANCE 487 PRINT: PRINT" SORRY I CAN'T HELP YOU. 1 AM APRAID YOU ARE GOI TO HAVE TO USE HUMAN INTUITION ON THIS ONE: ":PRINT:PRINT"BETTER LUCK NEXT TIME. "]:PRINTTAB(40) "PRESS / KEY."]:GOTO540
488 PRINT:PRINT:PRINTTAB(40) "PRESS / KEY."
489 1F INKEY\$<-"/"THEM489ELSECLS 490 IF SP/SA THEN CF=INT(188-(SA/SF)*188)
495 IF SA/SF THEN CA=INT(188-(SF/SA)*188)
580 PRINT0448, MY RECOMMENDATION IS MADE WITH A CONPIDENCE LEVEL OFF; 505 IF SE>SA THEN PRINT CF; """: PA=CF 510 IF SA>SP THEN PRINT CA; """: FA=CA 511 FORT=1T02000: NEXT: CLS: PRINT: PRINT: PRINT: PRINT: PRINT: PRINT: 515 IF FA-SO THENPRINT UNFORTUNATELY, THIS IS NOT A VERY HIGH LE OF CONFIDENCE. YOU HIGHT JUST AS WELL FLIP A COIN! GOTO526
520 IF FACED THENPRINT THIS IS A MODERATE LEVEL OF CONFIDENCE. YOU CAN FEEL REASONABLY COMFORTABLE WITH MY RECOMMENDATION. ": GOT 525 IF PA>BO THEMPRINT THIS IS A HIGH LEVEL OF COMPIDENCE.

Program continues



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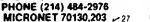
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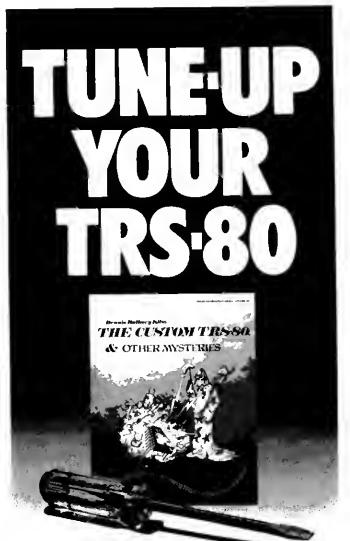
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Program continued

```
NOTHING IS SURE IN LIFE EXCEPT DEATH AND TAXES BUT THIS
   EVIDENCE LOOKS PRETTY CONCLUSIVE. "
526 PRINT:PRINT:PRINTTAB(48) "PRESS / REY.";
   527 IF INREYS<>*/"THEN527
538 CLS:PRINT:PRINT:PRINT:PRINT:PRINT"NOW THAT YOU HAVE MY OPINE
538 CLS:PRINT:PRINT:PRINT:PRINT:PRINT"NOW THAT YOU HAVE MY OPINI ON YOU ARE, OF COURSE.
FREE TO DO AS YOU PLEASE, ":PRINT
535 PRINT"HOWEVER, IF YOU ACCEPT MY ADVICE, YOU WILL KNOW THAT YOUR DECISION WAS BASED UPON A COMPLETE EXAMINATION AND
COMPARISON OF ALL THE ISSUES. "::GOTO550
548 IFINKEY$<."/"THEN548ELSE552
558 PRINT:PRINTTAB(40) "PRESS / KEY."
551 IF INKEY$<."/"THEN548ELSE552
552 GOSBUBJ36:POKE16825,188:FOKS-16089TO16345STEP64:POKES,191:NEX
T:POKE16216,138:S=1634.29:POKE5,176:POKES+1,184:POKE522,188:S=1693
2:POKE3,188:POKE5+64,191:POKE5+128,191:POKE16225,148
553 POKE16225,146
553 POKE16225,146
553 POKE16225,176:POKE16291,131:POKE16292,188:POKE16293,176:POKE
16294.1441:4-45:POKE-71TO76:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT:Y-46:FOKX-69TO73:SET(K,Y):KEXT
         16294,144:Y=45:FORX*71TO76:SET(X,Y):NEXT:Y=46:FORX+69TO73:SET(K,
     16294,144;Y=45:FORX=71TO76:SET(X,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=47:FORX=69TO73:SET(K,Y):NEXT;Y=47:FORX=69TO73:SET(K,Y):NEXT;Y=47:FORX=69TO73:SET(K,Y):NEXT;Y=47:FORX=69TO73:SET(K,Y):NEXT;Y=47:FORX=69TO73:SET(K,Y):NEXT;Y=47:FORX=69TO73:SET(K,Y):NEXT;Y=47:FORX=69TO73:SET(K,Y):NEXT;Y=47:FORX=69TO73:SET(K,Y):NEXT;Y=47:FORX=69TO73:SET(K,Y):NEXT;Y=47:FORX=69TO73:SET(K,Y):NEXT;Y=47:FORX=69TO73:SET(K,Y):NEXT;Y=47:FORX=69TO73:SET(K,Y):NEXT;Y=47:FORX=69TO73:SET(K,Y):NEXT;Y=47:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO73:SET(K,Y):NEXT;Y=46:FORX=69TO
   @:POREL5941,170
558 PRINTES4,LUS::PRINTE118,LLS;:PRINTE644,RUS;:PRINTE788,RLS;
559 Y=15:FORX=29TO11STEP=2:SET(X,Y):NEXT:SET(11,14):Y=13:FORX=11
TO22STEP2:SET(X,Y):NEXT:X=22:FORY=13TO7STEP=2:SET(X,Y):NEXT
560 Y=7:FORX=21TO11STEP=2:SET(X,Y):NEXT:X=1:FOPY=7TO13STEP2:SET(X,Y):NEXT:Y=13:FORX=1TO11STEP2:SET(X,Y):NEXT
561 PRINTE194, "GOOD=BE":
562 FORX=1TO8:PRINTE954,CHRS(18);:FORT=9TO488:NEXT:FRINTE54,LUS;
:FORT=9TO580:NEXT:NEXT:CLS
663 FRU
           TO SERVICE OF THE SER
           66 : POKEBO+X+63 . 166 : NEXT
           588 POKEN, 191: POKEN+1, 191: FORX=N+2TON+5: POKEX, 143: NEXT 585 R=N+64
                                          POKEN . 191 : POKEN+1 . 191
             595 N=N+64
           599 POKEN,191:POKEN+1,191:FORX*N+2TON+5:POKEX,188:NEXT
689 D-15762:POKEO,191:POKEO+1,191:POKEO+2,141:POKEO+1,141:POKEO+4,191:POKEO+5,191
           615 PONEO,191:PONEO+1,191:PONEO+2,188:PONEO+3,188:PONEO+4,191:PONEO+5,191
             628 0=0+64
             625 POKEO,191:POKEO+1,191:POKEO+4,191:POKEO+5,191
630 P=15773
635 POKEP,191:POKEP+1,191:POKEP+2,143:POKEP+3,143:POKEP+4,191:PO
               KEP+5,188
648 P=P+64
                                                POKEP,191:POKEP+1,191:POKEP+4,191:POKEP+5,191
               658 P-P+64
655 POKEP,191:POKEP+1,191:POKEP+2,188:POKEP+1,188:POKEP+4,191:PO
                 KEP+5,143
660 Q=15783
           665 POKEQ, 191:POKEQ+1,191:FORX=Q+2TOQ+5:POKEX,143:NEXT
678 Q=Q+64
675 POKEQ,191:POKEQ+1,191:POKEQ+2,143:POKEQ+3,143
               688 0-0+64
           000 04-006
685 POKEQ,191:POKEQ+1,191:PORX+Q+2TOQ+5:POKEX,188:NEXT
690 R-15794
695 POKEP,143:POKER+1,143:POKER+2,191:POKER+3,191:POKER+4,143:POKER+5,143
               785 POKER+2,191:POKER+3,191
718 R*R+64
715 POKER+2,191:POKER+3,191
               728 FORT*ITO1888:NEXT
725 WS=" COMPUTER ASSISTED DECISION EVALUATION TECHNIQ
               718 CLS:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT
               735 FORX=1TO59:PRINTHID$(W$,x,1)::FORT=1TO15:NEXTT,X:FORT=1TO100 0:NEXT
               736 REH * COMPUTER GRAPHIC
736 REH * COMPUTER GRAPHIC
737 CLS:S=15375:POKES,191:FORX=S+1TOS+3:POKEX,131:NEXT:FORX=S+4T
OS+23:POKEX,179:NEXT:FORX=S+24TOS+31:POKEX,131:NEXT:POKES+32,191
               738 S=15439; POKES,191: POKES*2,188: POKES*3,131: POKES*24,131: POKES
*25,188: POKES*29,131: POKES*37,191
739 S=15583: POKES,191: POKES*2,191: POKES*8,131: POKES*9,135: POKES*40,129: POKES*19,135: POKES*410,129: POKES*19,135: POKES*420,129: POKES*25,191: POKES*28,191: POKES*29,191: POKES*39,191: POKES*39,191:
               S+32,191
748 S=15567:POKES,191:POKES+2,191:POKES+8,168:POKES+13,142:POKES+14,141:POKES+19,144:POKES+25,191:POKES+28,131:POKES+13,142:POKES+14,141:POKES+19,144:POKES+25,191:POKES+28,131:POKES+25,191:POKES+32,191
741 S=15631:POKES,191:POKES+7,191:POKES+9,137:FORX=S+18TOS+17:POKEX,176:NEXT:POKES+18,134:POKES+25,191:POKES+32,191
742 S=15695:POKES,191:POKES+37,191
743 S=15695:POKES,191:FOKX=S+1TOS+5:POKEX,176:NEXT:FORX=S+6TOS+2
1:POKEX-14,11:POKES-37,191:FOKX=5+1TOS+5:POKEX,176:NEXT:FORX=S+6TOS+2
1:POKEX,186:NEXT:FORX=S+2TOS+31:POKEX,176:NEXT:POKES+32,191
744 S=15821:FOKX-STOS+36:POKEX,176:NEXT
745 S=15825:POKES,191:FOKX=S+4TOS+24STEP2:POKEX,148:NEXT:FORX=S+2TOS+31:TOS+5-36,191:TOXT-S+2TOS+31:TOXT-S+2TOS+31:TOXT-S+36,191:TOXT-S+2TOS+31:TOXT-S+36,191:TOXT-S+2TOXT-S+36,191:TOXT-S+2TOXT-S+36,191:TOXT-S+2TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S+36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-36,191:TOXT-S-
                   5+32.191
                 745 S=15885; POKES, 191; FORX=S+4TOS-248TEP2: POKEX, 148: NEXT: FORX=S+
29TOS+31STEP2: POKEX, 148: NEXT: POKES+36, 191
746 S=15949; POKES, 191; FORX=S+4TOS-248TEP2: POKEX, 179: NEXT: FORX=S+
29TOS+31STEP2: POKEX, 179: NEXT: POKES+36, 191
747 S=16013: POKES, 143: FORX=S+1TOS+15: POKEX, 148: NEXT: POKES+36, 143
:FORT=1TO488: NEXT: RZTURN
748 Y=16: FORX=29TO18STEP-2: SET(X,Y): NEXT: X=18: FORY=17TO34STEP2:
SET(X,Y): NEXT: Y=15: FORX=8PTO127STEP2: SET(X,Y): NEXT: X=127: FORY=15TO
47STEP2: SET(X,Y): NEXT: Y=47: FORX=127TO9STEP-2: SET(X,Y): NEXT: X=8: FORY=17TO34STEP2: SET(X,Y): NEXT: X=8: FORY=17TO35TEP2: SET(X,Y): 
                 ORY=47T035STEP-2:SET(X,Y):NEXT:Y=47:FORX=127T0@STEP-2:SET(X,Y):NEXT:X=8:F
749 PRINT@778, "HELLO! I'M YOUR COMPUTER. THE PROGRAM YOU HAVE
PUT INTO MY";
758 PRINT@834, "MEMORY WILL ASSIST YOU TO REACH A LOGICAL DECISIO
N ABOUT ANY";
```

```
Program continued
 751 PRINT@898, *PROPOSED ACTION YOU MAY BE CONTEMPLATING.
 S '/ ' KEY.)";
752 1F INKEY$<>=/"THEN752
 752 IF INREYS()
753 CLS:RETURN
765 REM * MEAD
770 CLS:S*15513
 775 POKES,160:POKES+1,176:POKES+2,176:POKES+3,152
786 FORX-S+4TOS+14:POKEX,140:NEXT
785 FORX-S+15TOS+17:POKEX,176:NEXT
790 S-15574
795 POKES, 160: POKES+1,152: POKES+2,134: POKES+3,129
000 POKES+26,130: POKES+21,137: POKES+22,164: POKES+23,144
005 S=15637
610 POKES,152:POKES+1,129:POKES+24,130:POKES+25,164
815 S=15700
       POKES,152:POKES+1,129:POKLS+27,137:POKES+28,144
S*15764
825
830 POKES,149:POKES+3,143:POKES+4,132:POKES+28,170
040 POKES, 152: POKES+1, 134: POKES+30, 170
       S=15600
 850 POKES, 182: POKES+1, 176: POKES+2, 176: POKES+30, 160: POKES+31, 133
869 POKES,169:POKES+5,144:POKES+25,152:POKES+26,134:POKES+27,129
878 POKES, 167: POKES+1, 147: POKES+2, 131: POKES+3, 131: POKES+4, 129: POKES+20, 176: POKES+21, 140: POKES+22, 134: POKES+23, 131
8/3 FOKES, 130: POKES+1,131: POKES+2,140: POKES+3,176: POKLS+4,176: POKES+16,152: POKES+17,134: POKES+16,131
885 S=16155
 090 POKES,149:POKES+10,170
895 S=16219
900 POKES,161:PORX*S+1TOS+9:POKEX,176:NEXT:POKES+10,106:PRINT026
,**NORKING RAM CHIP*::FORT*1TO500:NEXT
905 FORH*1TO6:PRINT0347,*T H 1 N K 1 N G*;:FORT*1TO250:NEXT:PRINT0347,*

";:FORT*1TO100:NEXT:NEXT:FORT*1TO500:NEXT
906 REM * WMEELS TURNING
907 PRINTE245, "WHEELS"; PRINTE312, "TURNING!"; PRINTE371, "<*;: PRI
NTE372, STRINGS19, "="); r= 3: FORT=1T0800: NEXT: FORX=8T0375STEP7
908 BET(8, C]: R=P-05: NEXTX
918 FORT=0T0700: NEXT: S=15936
```

915 POKES, 180: FORX+S+1TOS+14: POKEX, 140: NEXT: POKES+15, 100 925 POKES, 191: POKES+15, 191: POKES+16, 176: POKES+17, 148: POKES+16, 13

POKES,143:FORX=S+1TOS+14:POKEX,140:NEXT:POKES+15,143
PRINTM642,"OK I'M READY";:FORT=1TO1000:NEXT:CLS:RETURN

930 S=16064

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ere's a computer dice game to help you while away your time. I call it Micro Yahtzee.

The game first displays the instructions. Play begins when your roll is sorted into order and displayed. Use the INKEY\$ function for ell the entries so they are quick and easy. During the game the scores for eech category appear continuously and the display indicates

Lines 0-105

Lines 106-3707

Lines 3600-3960

Linas 4000-4030

Lines 5000-5100

Lines 8000-8190

Lines 7000-7200

Lines 8000-8010

Lines 8600-8520

Lines 10000-10200

Lines 11000-11075

Lines 12000-12100

Lines 12200-12225

Linas 16000-18060

Lines 17000-18000

Lines 19000-19090

Line 15000

Lina 15006

whether each category has displayed.

been used or voided yet. After you roll, select your category. The program checks your dice against your selection and then tells you to make another selection (if you have used that category elreedy), or gives you zero for thet category if the dice don't apply, or gives you the eppropriate points. At the end of the game your point totals and bonuses are displayed. Then the averages for each category end for each player for the games pleyed ere figured end

a. Initialize variables b. Display categories and accres a. Roll dica and change selected dica b. Category selection subroutine outs new scores into active players' variables subroutine counts dice for bonus selection subrouting checks for 3 or 4 of a kind subrouting checks for full house subroutine chacks for small or large straight aubroutine checks for Yahtzee subroutine totals dice for chanca subroutine sets up temporary set of category numbers a. Check for bonus aligibility b. Totals scores for gama c. Check for new high or low score subroutine sets player one's scores to strings subroutine sets player two's accras to strings subroutine clears portion of screen subrouting clears portion of screen subroutina sorta dice into ordar totals all accres & displays summary instructions for game

Table 1. Line Description

You will enjoy this computer the easy to read display and the version of Yehtzee because of safeguards egeinst errors.

Program Listing

```
8 CLEARIS9:DIM N(72):H(49)=1:N(58)=2:N(51)=3:N(52)=8:H(53)=5:M(5

4)=6:N(65)=7:H(66)=8:N(67)=9:N(68)=10:N(69)=11:H(78)=12:H(71)=13

:N(72)=14:LT=58

1 CLS:PRIMY* H I C R O - Y A H T Z E E*:PRINT:PRINT*INSTRUCTIONS

? (Y) OR (N)*;

2 NS=INKEYS:IPNS="*THEN2

3 IPNS="Y"THEN19880

5 RANDOM:Cl=1:DINP1(14),B(13),B$(13),P2(14),A(14),P1$(13),P2$(13),P2$(13),P2$(14),P4(14)

6 CLS:INPUT"ENTER 1ST PLAYER'S NAME";P1$:INPUT"ENTER 2ND PLAYER'S NAME";P2$

18 G1=8:CLS:PORA=1T013:A(A)=.5:P1(A)=.5:P1$(A)=" "":P2$(A)=" "":

P2(A)=.5:NEXTA:A(14)=.5:CLS

C2 PRINTERS96,"
"GOSUB18808

65 FORA=1T013:READB(A):EXXTA:PORA=1T013:READBS:PRINT®B(A1,85;P1$
   65 FORA-ITO13:READB(A):NEXTA:FORA-ITO13:READBS:PRINT@B(AI,8$;FI$
(A); ";:PRINT@B(A)+23,P25(A);NEXTA:IFGI=26THEN118@8
66 PRINT@768,P35;"'S TURN";
   3289 PORR-1TOS: B(X) = INT(RND(0)*6)+1:NEXTM
3222 GOSUB1680.
3388 PRINT@996, "YOUR ROLL IS..", H(1); H(2); B(3); H(4); B(5);
3488 PRINT@995," HON NAMY CHANGES PAL ";:NS=INKEYS:IPNS=""TH
EN3468BLSEN=VAL(NS)
3485 IPNS("8"ORNS)"5"THEN3488
3549 PRINT@925," WHICH ";"{";N;"}";" ";
3565 IPN-5THENP(1)=1:P(2)=2:P(3)=3:F(4)=4:P(5)=5:GOTO3500
3525 IFM-0S=2:GOTO3590
3538 PORO-1TON
3535 PS(0)=INEYS:IPPS(0)=""THEN3535
3540 PRINT@953-N," ";:IFPS(0)("0"ORPS(0)>"5"THEN3535BLSEP(0)=VAL(PS(0)):PRINT@1085,"CHANGED *",P(0);
3570 NEXTO
3575 POAM2=1TO56:NEXTM2:PRINT@1085,"
";
3580 PORQ-1TON: R(P(0))=INT(RND(0)*6)+1:NEXTO
   3575 POANZ-ITO56:NEXTW2:PRINTP1885,"
3589 PORQ-ITON:B(P[Q])=INT(RND(0)*6)+1:NEXTQ
3580 C=0
3680 FORQ-ITO4
3610 IPH(Q)<-86(Q+1)THEN3650
3620 T=M(Q):M(Q)=H(Q+1):H(Q+1)=T:C=C+1
3650 NEXTQ
3660 IRCOTTBEN3590
3670 PRINTP8956,"YOUR ROLL IS...";R(1);H(2);H(3);8(4);H(5);:S=S+1
3690 IPS(2TBEN3400)
3700 PRINTP8956,"PINAL ROLL--->";H(1);B(2);H(3);B(4);B(5);"
    3708 PRINT9896, "FINAL ROLL--->";H(1);B(2);H(3);B(4);B(5);"
ENTER OPTION ";:NS=INKEY$;IPNS="THEN3700"
3701 T1=ASC(NS)
     3782 1PT1<490RT1>54ANDT1<650NT1>72THEH3788
3783 T=N(T1)
                                                                                                                                                                                                       Program continues
```

```
4885 V-8
4885 FORC-1TOS
4883 FORC-1TOS
4818 IFR (U) -TTHENV-V+1
4828 NEXTU
4828 NEXTU
5885 IFT-7THENS5-3
5816 IFT-8THENS5-6
5828 PORB2-1TOS
5838 FORB3-1TOS
5838 FORB3-1TOS
5848 IFR (82) -H(83) THENS6-86+1
5858 NEXTB3
5866 IFRS (85THENS5)88
5868 NEXTH2
5868 NEXTH2
5868 NEXTH2
5865 B-86-1A(T)-8:RETURN
   5885 NE-KTM2
5885 NE-6:A(T) = B:RETURN
5188 A(T) = R(1) + H(2) + H(3) + H(4) + H(5) : B6 = B:RETURN
6888 H3 = 1
6828 FORF2 = 2TO5
6838 IFH(1) = H(F2) THENE | B8
6848 N2 = M2 + ID(N2) = H(F2) : GOTO6118
6188 N3 = M3 + M3 + I
 6188 N3-H341
6188 NS-H341
6188 NEXTP2
6128 POREI-ITOH2
6138 IPD(1)-D(E1)THEN6158
6148 A(3)-B; N2-B; NETURN
6158 NEXTE1
6168 IFN2-DITHENG148
6178 IFN2-DITHENG148
6188 IF(M2-H3)<>5THEN6148
6188 A(3)-D5; N2-B; NETURN
7888 G3-B; L1-B
7818 IFT-ISTHEN7788
7818 IFT-ISTHEN7788
7828 IFH(1)-H(2)-1ANDH(2)-H(3)-1ANDH(3)-E(4)-1ANDH(4)-H(5)-1THEN
7288
    7838 A(11) = 8: RETURN
7108 W1=0
   7182 PORA-1T05:W(A)=9:NEXTA
7182 FORA-1T05
7184 IFH(A)=8(A+1)THEN7187
7185 W(=W1)=H(A)
7187 NEXTA
7186 W(W1)=H(A)
7187 NEXTA
7188 IFW(1)+1-W(2)ANDW(2)+1-W(3)ANDW(3)+1-W(4)THEN7158
7189 IFW(2)+1-W(3)ANDW(3)+1-W(4)ANDW(4)+1-W(5)THEN7158
71122 A(18)=8:RETURN
7128 A(18)=35:RETURN
7128 A(18)=35:RETURN
7188 A(18)=35:RETURN
7188 A(11)=48:RETURN
7188 A(11)=48:RETURN
7152 A(18]=35;RETURN
7288 A(11)=46;RETURN
8888 [R(1)=4(2)=H(2)ANDH(2)=H(3)ANDH(3)=H(4)ANDH(4)=H(5)THENA(12)=58;
RETURN
8518 A(12)=8;RETURN
8518 A(13)=8
8518 FRETURN
18588 A(13)=8
8518 FRETURN
18688 C1=C1=1;IFC1/2<>1NT(C1/2)THEN1818
18688 C1=C1=1;IFC1/2<>1NT(C1/2)THEN1818
18688 C1=C1=1;IFC1/2<>1NT(C1/2)THEN1818
18688 A(1-1)
18718 FORA=1TO(3:A(A)=P1(A):NEXTA
18718 FORA=1TO(3:A(A)=P1(A):NEXTA
18718 FORA=1TO(3:A(A)=P2(A):NEXTA:RETURN
18718 FORA=1TO(3:A(A)=P2(A):NEXTA:RETURN
18718 FORA=1TO(3:F7=F7+P1(A):NEXTA
18718 FORA=1TO(3:F7=F7+P1(B):NEXTA
18718 FORA=1TO(3:F7=F7+P1(B):NE
       11867 IFT1-T2THENN3-W1+1
11878 T)-T3+T1:Y4-T4+T2:T5-T5+1:PRINT9384, PUSH ANY KEY TO CONTI
      NUE":
11871 L55=INXEYS; IPL55=""THEN11871
11874 COSUB17888
11875 COTO18
12885 PORA-1TO13
12885 P1$(A)-STR$(P1(A))
12818 IFP1{A}-STR$(P1(A)-" X"
12815 IPP1{A}-STR$(P1(A)-" ""
12825 IPP1{A}-STR$(P1(A)-" ""
       12828 MEXTA
12188 RETURN
12288 FORA-1TO13
12285 FORA-1TO13
12285 P2$(A) = STR$(P2(A))
12218 IPP2(A) = GTBENP2$(A) = " x"
12215 IPP2(A) = .5THENP2$(A) = " *
12228 MEXTA
12225 RETURN
       12225 RETURN
15885 PRINTS866," ("::RETURN
15885 PRINTS891," ["::RETURN
16886 C=8
16818 FORQ=1T06
16828 ITH(Q) <=8 (Q+1) THEN16848
16838 T-H(Q):B(Q)-B(Q+1):B(Q+1)=T:C=C+1
                                                                                                                                                                                                                                                                                                                                                                                     Progrem continues
```

Program continued

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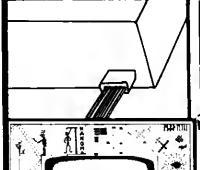
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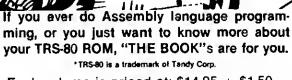
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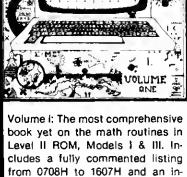
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You sometimes must use them to get the most out of your disparate program library.

Building Bridges

Weyne L. Mueller 130 Sunset Court Roswell, GA 30075

At one time or another, almost all of us have bought software that did everything that it claimed, but still didn't do exactly what we had in mind. When this happens, we usually either change our mind about what needs to be done, or change the software to do what we originally had in mind. In this case, I did neither. Rather, I found two pieces of software and built a bridge between them. Taken together, they do exactly what I want.

Special Delivery

On one side of the bridge we have Special Delivery by Software Concepts. This is a very nice mail-list processor that merges a letter text file with a name and address file to produce highly personalized form letters.

if your letter starte with "Dear Mr. <L:", the Mailrite program will substitute a lest

name for the <L, so that it printa as Dear Mr. Adams, Dear Mr. Baker, or whatever last names may appear in your name and address file. In all, there are eight fields in the name and address file that may be substituted anywhere in the body of your letter. Other "<" flags allow you to toggle underscores and boldface on and off, change margins dynamically, and provide other slick features too numerous to mention here. (See the July, 1980, 80 Microcomputing for a review.) The problem is that six of the eight fields have to do with the name and address, leaving only two fields to store data about that person or company. For my purposes, two is not enough.

AIDS3

Enter AIDS3, by Meta Technologies. AIDS has no text insertion capability, but is a superior data manager. The user may define up to 20 fields of either character or numeric type. In addition, there is a more comprehensive search and select capability. There are no exaggerations in MTC's ads. If anything, the claims are

understated. If all you need is a data manager and report generator, AIDS3 and its companion programs are top notch.

The Bridge

As you might expect, the file structures differ between AIDS and Special Delivery, so that a file written by one cannot be read directly by the other. That's where the bridge comes in. The conversion Program Listing moves any of AIDS' 20 fields to or from any of Special Delivery's eight fields, and does it in a format that is readable by the destination program.

What this means to me is that even after using six of the 20 AIDS fields for name and address information, I still have up to 14 fields to store data for insertion into form letters. Normally I do my data entry, editing and selection with AIDS, and then move the selected data to the Special Delivery format for form letter generation.

The conversion program operates very simply. The program asks for and accepts the names of the files involved, and which way to convert. The respective file formats are then

displayed, (Fig. 1) and you select which field is to be moved where. As each selection is made, the arrows to the left of the screen (Fig. 2) depict the source and destination fields. In the example shown, an AIDS file is being converted to Special Delivery, AIDS fields A through F are being moved to the corresponding Special Delivery fields one through six, while AIDS fields M and L are being moved to Special Delivery fields six and eight respectively. Entering the slash (/) character ends the selection, and causes the conversion to take place.

All Special Delivery fields are atored as left-justified characters, and padded on the right with underline characters to fill out the field. AIDS' character fields are padded on the right with blanks, while numeric fields are right justified and padded on the left with blanks. The conversion process accomodates these conventions, so that the converted file appears identical to what would have been produced by the destination program. If the destination field is smaller than

```
Member/lst:1
                        Member/det:1
                                                K Pledge $#6
1 Name 25
                      A Name = 25
2 Company 25
                      O Company = 25
                                                L $ to Date#6
3 Address 25
                      C Address = 25
                                                M Committee#18
4 City 18
                      O City = 18
                                                N Officer?#1
5 State 2
                      E State = 2
6 Zip 5
                      FZID = 5
7 Date 1 14
                      G Wite Name = 12
8 Deta 2 14
                      H = Children-3
                      I Member Yrs-4
                      J Birthday-18
                    To or From Member/dat:1?
                            Fia. 1
```

```
Member/lst:1
                            Member/dat:1
                                               K Pledge $-6
A = = > 1 Name 25
                           A Name-25
6 = = > 2 Company 25
                          & Compeny-25
                                               L $to Date-6
C = = > 3 Address 25
                          C Address-25
                                               M Committee-18
D = = > 4 \text{ City } 18
                          O City-18
                                               N Officer?-1
E = = > 5 State 2
                          E State-2
F = = > 6 \text{ ZIp } 5
                           F Zip-5
M = => 7 Data 1 14
                          G Wife Name-12
L = = > 8 Dala 2 14
                           H # Children-3
                           I Member yrs-4
                          J Birthday-18
                                  Next?..
                            Fig. 2
```

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the source field, the source is truncated on the right or left as appropriate to the destination.

No changes to Special

Delivery and only minor changes to AIDS are required. Special Delivery handles lower-case characters while AIDS

does not. Simply go through AIDS and locate the occurrences of CH = 90. Change them to CH = 122 and you have

lowercase AIDS. This naturally assumes that your TRS-80 has a lowercase conversion installed.■

```
100 DEFINT A-2:CLEAR 1000
110 'DEFINE MACHINE CODE IN MLS
120 MLS-STRINGS(26,32):X=VARPTR(MLS):X1=PEEX(X+1):X2=PEEX(X+2)
130 IF X2>127 THEN X2=-X2:X1=X1-1 ELSE X2=256*X2
140 X=X1+X2:DEFUSR@-X:FOR X1=0 TO 25:READ X2:POKE X+X1,X2:NEXT
150 CLS-CHRS(31) 'CLEAR SCREER
160 GOSUB 3500 'GET FILE NAMES
170 GOSUB 2000 'OPEN 4 READ DESC FILE
180 GOSUB 2000 'DISPLAY AIDS FIELDS
190 GOSUB 2000 'OPEN AIDS FILE FOR 1/O
200 GOSUB 2000 'OPEN AIDS FILE FOR 1/O
200 LTS="ABCDEFGHIJKHNOPQAST" 'VALID LETTERS
250 LTS="ABCDEFGHIJKHNOPQAST" 'VALID LETTERS
250 LTS="ABCDEFGHIJKHNOPQAST" 'VALID LETTERS...THIS AIDS SYSTEN
260 NRS="1234567@" 'VALID NUMBERS FOR S-D
270 GOSUB 3000 'GET & VALIDATE XFRR INFO
280 IF TF=1 THEN GOSUB 4000 ELSE GOSUB 4300
290 CLOSE:END
2000 'SUBR TO OPEN & READ AIDS DESC FILE
   290 CLOSE:END
2000 'SURE TO OPEN & READ AIDS DESC FILE
2010 OPEN*1*,3,P3$
2020 INPUT03,As,As,TL,NF 'DMY,DMY,TOT REC LEN,0 FLDS
2020 INPUT03,As,As,TL,NF 'DMY,DMY,TOT REC LEN,0 FLDS
2020 INPUT03,As,As,TL,NF 'DMY,DMY,TOT REC LEN,0 FLDS
2020 IN AMS(NF),AL(NF),AS(NF),AS(NF) 'NAME,DEN,STRT,BKTS
2040 FOR I=1 TO NF:INPUT03,ANS(1),AL(I) 'FLD NAME & LENCTH
2050 IF AL(I)<0 THEN INPUT03,AS(I),AS(I) ELSE INPUT03,AS(I)
2060 NEXT.CLOSE03:RETURN
   2860 NEXT:CLOSE43:RETURN
2180 'SUBR TO DISPLAY AIDS FIELDS
2110 CLS:PRINT940,P2$, 'DISP AIDS NAME
2120 NS=686 'START PRINT POS
2130 POR I=20 TO 1 STEP -1:IF I>NF THEN 2150
2140 PRINT9NS,CHR$(64+I); " ";AMS(I); "--";ABS(AL(I));
2150 NS=NS-64:IF NS<64 THEN NS=666
2160 NEXT:RETURN
2280 'SUBR TO DISPLANCE TO THE THEN THEN 2150
 2468 SYS-ARS(TF): PRINTENS-6, ARS(3-TF): RETURN
2608 'BEEP ROUTINE
2618 FOR I=1 TO 25:OUT 255, 4:OUT 255, 8:REXT: RETURN
2708 'OPEN AIDS FILE FOR I/O
2718 OPEN MIDS("OI", TF, 1), 2, 22: RETURN
3500 'S UB TO GET FILENAMES
3510 PRINTEO, CLS: PRINTEO, "MAILFORM/AIDS FILE CONVERSIONS"
3520 PRINTEO, CLS: PRINTEO, "MAILFORM/AIDS FILE CONVERSIONS"
3538 NS-283:F-1: COSUB 3700:F1$=FS
3540 PRINTE336, "AIDS FILE? ";:LINEINPUT FS
3550 NS-383:F-1: COSUB 3700:F1$=FS
3560 PRINTE389, "AIDS DESCRIPTOR FILE? ";:LINEINPUT F$
3560 PRINTE389, "AIDS DESCRIPTOR FILE? ";:LINEINPUT F$
3578 NS-411:F-3:IF FS=" THEN FS-F05:GOSUB 3750 ELSE GOSUB 3760
3580 F3$=FS: FRINTE41, "OX? ";
3590 LINEINPUTFS: IFLEPTS(FS,1)="Y" THEN RETURN ELSE GOTO 3510
3760 'ASSIGN DEFAULT EXT & DRIVE
3710 A)=INSTR(FS,"/"):A2=INSTR(FS,":"):FRS=":1"
3720 IP A1>0 AND A2>0 THEN RETURN
3730 IP A2>0 THEN RES-RIGHTS(FS,2):FS=LEFTS(FS,A2-1)
3740 F0S=FS
      3740 P8S=F$
3758 PS=FS+MIDS("/LST/DAT/DSC",4"F-3,4)+FRS:PRINTENS,PS:RETURN
```

```
3888 'SUB TO VALIDATE PLD XPER INFO
3810 NS=918:PRINTPNS,CLS; NEXTT ";:NS=NS+6:FL=2:GOSUB 4588
3820 TXS=818:IF AI=42 THEN 3960 'STD XFER
3838 IF AI=47 THEN RETURN 'END INFO
3848 LS=LEFTS;TXS,1):RS=RIGHTS;TXS,1)
3858 L=INSTR(RS,LS):IF LOO THEN LI=1:GOTO 3878
3860 L=INSTR(RS,LS):IF LOB THEN LI=2:GOTO 3888 ELSE GOTO 3988
3868 LS=INSTR(LTS,RS):IF ROB THEN RI=2:GOTO 3918 ELSE GOTO 3988
3888 RSINSTR(LTS,RS):IF ROB THEN RI=2:GOTO 3918 ELSE GOTO 3988
3888 RSINSTR(RS,RS):IF ROB THEN RI=1:GOTO 3918
3988 NS=852:PRINTENS,TXS; 'INVALID';:GOSUB 2618:GOTO 3818
3918 IF LI=R1 THEN 3988
3928 IFLI=1THEN X=R:Y=L ELSE IF LI=2 THEN X=L:Y=R ELSEGOTO3988
3938 AK(X)=Y:SC(X)=X:NS-645Y:PRINT@NS,CHRS(64+X)+SYS;
3948 PRINT@852,CLS;:GOTO 3818 'CLEAR ERR & RESUME
3958 'STD XPER
3958 FOTD XPER
   3966 POR I=1 TO SF:SZ(I)=1:PRINT@64*I,CHR$(64*I)+SY$;:NEXT
3976 POR I=1 TO NF:AZ(I)=1:NEXT
3986 GOTO 3946
4089 'SUB TO CONV S-D TO AIDS
   4010 B$=STRING$\f\_32\:eC$=CHR$\(236\):UL$=CHR$\(95\):RN=0
4020 FOR K=1 TQ LOP(1):NR=NR+1:GET I,NR
4030 FOR I=1 TO SR
  4040 IF INSTR(RP$(1,1),EC$)>0 THEN 4130
4050 FOR J=1 TO SP 'FOR ALL FIELDS
4050 FOR J=1 TO SP 'FOR ALL FIELDS
4050 LOST ANS(J)=BS
4070 UL=INSTR(RP$(1,AZ(J)),UL$):IF UL=1 THEN 4110 ELSE IF UL=0 T
   HEN 4898
  HEN 4090
4080 AS=LEPTS(RFS(I,AZ(J)),UL-1):GOTO 4100
4090 AS=RFS(I,AZ(J))
4100 IP AL(J)>0 THEN LSET AAS(J)=AS ELSE RSET AAS(J)=AS
4110 PRINT02,AAS(J);:REXTJ:PRINT22,"
4120 RN=RN+1:PRINT0714,RN; "RECORDS WRITTEN TO ":F2S:NEXT I,X
    4138 CLOSE: END
4388 ' SUB TO CONV AIDS TO S-D
  4388 'SUB TO CONV AIDS TO S-D
4318 NR=8:RC=8
4328 POR I=1 TO SR 'FOR ALL SUB RECS
4338 IP EOF(2) THEN 4448
4348 LINEINPUT42,AS:POR J=1 TO SF 'FOR ALL FLDS
4348 LINEINPUT42,AS:POR J=1 TO SF 'FOR ALL FLDS
4358 TS=STRINGS (LEN(RP$(I,J)),32)
4368 XS=#IDS(AS;AS[SZ(J]),ABS(AL(SZ(J))))
4378 IP AL(SZ(J))>0 THEN 4418
4388 FOR K=1 TO LEN(XS):IF MID$(XS,K,1)<>" " THEN 4488
4398 NEXT X;GOTO 4418
4488 RE=1:XS=RIGHT$(XS,LEN(XS)-K)
4418 MID$(T$;1)=XS
4428 X=USR(VARPTR(T$)):LSET RF$(I,J)=TS:NEXT J
4438 RC=RC+1:PRINT9714,RC;"RECORDS WRITTEN TO ";FIS:NEXT I
4448 NR=WR+1:PUT 1,NR:IF EOF(2) THEN 4458 ELSE GOTO 4328
4458 CLOSE:END
    4448 RM=WR+1:PUT 1,NR:IF EUF(2) THER 4430 ELSE COLO 3320
4548 CLOSE:END
4598 'KEYBOARD INPUT ROUTINE
4518 FS-0:ANS="":CRS-CHRS(13):CPS=CHRS(14):CNS=CHRS(15)
4528 PRINTPMS+FS,CTRINGS(FL-FS,136)
4538 PRINTPMS+FS,CTPS:IS*INKEY$:PRINTPMS+FS,CNS;:IPI$=ANSTHEN453
     0

04540 Al=ASC(IS)

4550 IF AI=42 OR AI=47 THEN PRINTONS+PS,IS;:FS=FS+1:COTO 4600

4560 IP AI=8 THEN IF FS>0 THEN FS=FS-1:COTO 4530 ELSE 4530

4570 IF IS=CRS THEN 4600
     4580 PRINTENS+PS.15; IP A1<>8 THEN FS=PS+1 ELSE PS=FS-1
4590 IF FS<PL THEN 4520
4600 AIS=ANS:BP=15360+NS:FOR I=BP TO BP+FS-1:AIS=AIS+CHR$(PEEK{I
   4600 AIS=ANS.8P=15360+NS:FOR I=BP TO BP+FS-1:AIS=AIS*CHRS
)) NEXT:RETURN
4700 'DUMMY FIELDING POR AIDS FILE
4710 OPEN*R",3,F3S:DUMMY=0:FOR I=1 TO NF
4720 FIELD 3,[DUMMY) AE DUMMY_ABS(AL(I)) AS AAS(I)
4730 DUMMY=DUMMY+ABS(AL(I)):NEXT:RETURN
5800 DATA 265,127,10,806,01,05,78,35,94,35,86,235,9,43,65
5810 DATA 62,32,196,192,62,95,119,43,16,246,201
5820 DATA "NAME",25,"CDMPANY",25,"ADDRESS",25,"CITY",18
5830 DATA "STATE",2,"ZIP",5,"DATA 1",14,"DATA 2",14
```

Program Listing

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That Annoying Twitch

Marshall E. Smith 801 West Long Lake Road, Apt. F-1 Bloomfield Hills, MI 48013

an you remedy the twitch Jin my video display?" asked my grandson. He hed obtained an estimate for a professional repair job which included replacement of any doubtful ICs and a check of all solder connections. The size of the estimate meant a big hole in his cash reserves which he had planned to use for the purchase of peripherals. He remembered that I had done some do-it-yourself TV repairs and wondered if I could help him. With scant knowledge of computers, I reluctantly consented to tackle the problem.

Following the instructions in the TRS-80 Microcomputer Technical Reference Handbook we disassembled the case, trying not to strain the flexible connections and taking pains not to bend the logic board. We positioned the logic board with the devices up and the keyboard in an operable location, then plugged in the power supplies to the logic board and to the video display.

We turned on the power end checked the 12 volt, 5 volt and -5 volt supplies and found them satisfactory. I had learned thet the computer had worked well except for the annoying horizontal twitch which appeared periodically at the left side of the screen when an image was being displayed. The problem seemed to be independent of duration of operation or temperature end would

come and go without epparent cause. I connected my 3-inch oscilloscope and went to work.

With a display on the video, I connected the scope ground to the logic board ground, then dld some careful probing among the IC pins, working back from the output jack. This was done carefully because I did not want to short-circuit or ground any live pins. All probing was done on the side of the logic board on which the devices are mounted.

With no twitch on the video I found a nice, steady pattern on pin 3 of Z49. Waiting for the Inevitable twitch, which soon occurred, I probed the same pin and found the scope image was

vibrating. I then probed other plns in the area and found to my pleasant surprise that the twitching stopped when the probe was on pin 2 or 3 of Z50. It was evident that there was a slight tendency towards instability in that circuit and that a small amount of capacitance to ground might cure it.

Sure enough, a 27pF ceramic type capacitor from pin 3 of Z50 to pin 15 (ground) of Z49 solved the problem (see Fig. 1). Care was exercised not to overheat the pins of the ICs during soldering. After several operational tests indicated success, we reassembled the computer. It has been working faithfully for severel weeks now.

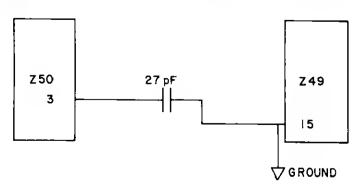


Fig. 1

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ne shortcoming of the TRS-80 disk system (TRSDOS) is the failure to provide an Initial Program Load (IPL) facility to take the user from power-up through to the desired Basic program without the need for numerous keyboard entries. The Auto Function with its one command limitation fails to solve the problem. Unless you happen to own, for example, Apparat's NEWDOS, you're stuck with a somewhat lengthy initialization sequence, particularly if loading I/O drivers. Out of such frustrations was born IPL/BAS.

IPUBAS

IPL/BAS is a Basic program suiteble for TRSDOS systems of 16K RAM and upwards. It allows the user to create a command file tailored to suit a particular IPL requirement. Each such file consists of a small machine language program plus the specified set of commands. For example, we might build a file called TAXIPL/CMD. Entering TAXIPL after power-up

(or setting Auto TAXIPL) might: might:

- set Verify (ON);
- load an I/O driver PRINT/ DVR;
- · load and execute Basic:
- reply <ENTER> to How Many Files?;
- reply 49000 to Memory Size?
- and run program TAX/BAS. TAXPASS:1.

All this without any further entries from the keyboard!

Program Oparation

To use IPL/BAS, key in the program and save to disk as IPL/BAS; be especially careful copying the data statements, lines 50 through 80. Whenever you want to set up en IPL command file, there are several steps to follow.

Execute Basic and reply 32511 to the Memory Size? query. (The command file Is built in RAM starting at 32512 (7F00 hex), so that area needs to be protected. In fact, IPL/BAS will refuse to run if you haven't sat the memory size correctly.)

Run IPL/BAS and when requested, key in the command set you require. Note that Enter should be typed as "+"; for example, to build the TAXIPL file outlined in the previous section, you would type:

VERIFY + LOAD PRINT/DVR + BASIC + + 49000 + RUN"TAX/BAS. TAXPASS:1" +

and then press Enter.

The program will return to TRSDOS, and you then write the command file to disk using the DOS Dump command. In

the case in question we would enter:

DUMP TAXIPUCMD (START = X'7F00', ENO = X'7FBF',TRA = X'7F00')

The command file is now ready for use.

Program Listing 1.

1			
7FØØ:	E5	PUSH HL	Save HL
72Ø1:	2A 15 4Ø	LD HL, (4\$16)) Get original KB driver addr
7FØ4:	22 28 7F	LD (7F2B), HJ	L Save it
7FØ7:	21 11 7F	LD HL, 7F11	Get intercept address
TPGA:	22 16 40	LD (4016) H	L Store in keyboard DCB
7FØD:	E1	POF HL	Restore HL
7FØE:	C3 2D 4Ø	JF 402D	Return to TESDOS
7F11:	DD ES	PUSH II	Save IA
/F13:	2 5	FUSH HL	Save HL
7F14:	2A 46 7F	LD HL, (7F46)) Get delay count
/F17:	70	LD A,H	
7∄18:	B5	CR L	Count zero?
/F19:	28 Ø4	JR Z, YFIF	Branch if yes
/F1B:	59	DEC HL	Decrement delay count
7F1#:		XOR A	Return X'90' to requestor
	18 20	JR /F3F	
/F1F:	DD 21 48 7F	LD IX, /F48	roint IX to command set
7F23:	DD /E ØØ	LD A, (IX+99)	Get next character
7F26:		BIT 7, A	Is it the last?
7F28:		JR Z,7F34	Branch if no
772A:		LD HL. ØØØØ	Restore KB driver address
7F2D:		LD (4016), H	t.
7F39:	CB BF	RES 7,A	Reset hi-order bit of last
1	18 ØL	JR 7F42	
	21 25 78	LD HL,7F25	Update character pointer
	34	INC (HL)	
_	PE ØD	CP ∯D	(ENTER)?
7F3A:	20 06	JR KZ,7742	
7F3C:	21 00 05	LD HL.0500	
77.31	22 46 7F	LD (7F46), H	L Store updated count
7£42:	£1	PCP HL	Restore HL
	DE E1	POP IX	Restore IX
	C9	RET	Return to requestor
	क्ष क्ष		(Delay count)
7F48:			(Command set starts here)

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```
18 CLS :CLEAR388 :DEFINT C,X,Y
28 QUS=CBR$(34) :MX5="MAXIMUM 120" :DE5="BASIC+++RUN"+QUS
30 IF PEEK(&H4881) + PEEK(&H4882)*256 < (&H7EFE) THEN 98 :REM CH
ECK MEMSIZE
 48 PRINTS 458, "** MEMORY SIZE NOT SET = 32511 OR LOWER - RUN
ABORTED *** , TANA
     ORTED *** :ENO
DATA 229,42,22,64,34,43,127,33,17,127,34,22,64,225,195,45,64,
 68 DATA 229,229,42,78,127,124,181,48,4,43,175,24,32,221,33,72,12
7,221
7.8 DATA 126,8,283,127,48,18,33,8,8,34,22,64,283,191,24,14,33,37
88 DATA 127,52,254,13,32,6,33,8,5,34,76,127,225,221,225,281,8,8
98 FOR X-(14H7F89) TO (6H7F47) : READ Y : POKE X,Y : NEXTX : REM POKE MACH LANG PROG
188 Y-1 : GOSSUB 388
118 PRINT "THIS PROGRAM CREATES AN AUTOMATIC DOS IPL ROUTINE , B
   BUILDING*
20 PRINT "IT IN RAM BETWEEN 7598 & 7585 ...... THE DOS 'DUM
     130 PRINT
 D' ) FILE.
149 Y=13 ;G
TING POOL
140 Y=13 :GOSUB 380 150 PISS PRINT "USER HUST SUPPLY THE COMMAND SET TO BE USED AFTER BOO TING DOS;"
160 PRINT "ANY EMBEDDED <ENTER>'S SHOULD BE CODED AS '+' - FOR EXAMPLE;"
170 PRINT "THE DEFAULT OPTION | SUPPLIED IF YOU SIMPLY BIT <ENTE
 180 PRINT TAB(22) DES
199 Y=28 :GOSUB 380
288 PRINT "NOW TYPE COMMAND SET [ *1 MX$; " CHARACTERS - AS MAR
 210 PRINT@ 768, CHR$(31);STRING$(120,".");"<--LIM17"; :PRINT@ 76
 228 LINEINPUT CS$ : IF CS$= " THEN CS$= DE$
226 LINEIMPUT CSS ::F CSS::THEN CSS-DES
238 CS-LENE(CSS) ::F CSS::THEN CSS-DES
244 FOR X=1 TO 8 ::EEM REMIND USER OF MAX 128
258 PRINTE 664, STRING$(11, ""): :GOSUB 288
258 PRINTE 664, MX$: :GOSUB 288
278 NEXTX ::GOTO 218
288 FOR X=1 TO 158 :NEXTY :RETURN ::REM DELAY LOOP
298 FOR X=1 TO CS
             CH=ASC(HIDS(CSS,X,1)) : IF CH+43 THEN CH=13 :REM "+"+(EN)
IF X=CS THEN CH=CH OR (6H80) :REM SET HI-ORD BIT ON LAST
POKE 6H7F47+X,CH :REM POKE SUPPLIED COMMAND SET
328 PURE OFFICE TABLE TO THE FOLLOWING DOS COMMAND , EXACTLY AS S HOWN : -****; 358 PRINT **** | THE FILESPEC '!PL/CMD' MAY BE VARIED AND/OR EXP ANDED ) ****
 368 PRINT "DUMP IPL/CMD (START "X'7F88', END "X'7F8F', TRA "X'7F88')"
370 CMD"S" :REM RETURN TO TREDOS
380 PRINT :FOR X-0 TO 127 :SET [X,Y] :NEXTX :RETURN
```

Program Listing 2

Paints to Note

There are several points to remember about this program.

The maximum length of a command set is 120 cheracters—usually more than enough, but you can, if nacessary, chain command files under DOS, i.e., have one invoke another.

You cannot use a command file to raply to Input, Line input, or INKEY\$ statements contained within a Basic program.

When running IPL/BAS, simply pressing Enter without typing a command set provides a default of Basic+++run" (i.e. load and execute Basic, reply Enter to the How Many Files? and Memory Size? queries, and then type Run. This allows the user to manually key in the name of the program to be run).

For Assembler/Machine Language Buffs

Command files each contain a 72-byte program in Listing 1, which is POKEd into RAM between X'7F00' and X'7F47'. The specified command set is POKEd into the next 120 bytes (X'7F48' to X'7FBF'). The area ebove X'7FBF' is not used, because it is overwritten on entry to Basic on a 16K machine.

On initial entry, the keyboard driver address at X'4016'/ X'4017' in the device control block is replaced by an intercept which effectively reroutes all subsequent keyboard requests to X'7F11'. The intercept routine at that address then passes the command set, one byte et a time, to the requestor (DOS or Basic). Before passing the last byte (identified by having bit seven set), the keyboard driver address is restored to its original value, thereby disabling the intercept and restoring the keyboard to normal operation. The delay loop prevents potential problems with functions that scan for Break during execution, as well as providing a little more time for you to observe what is happening! ■

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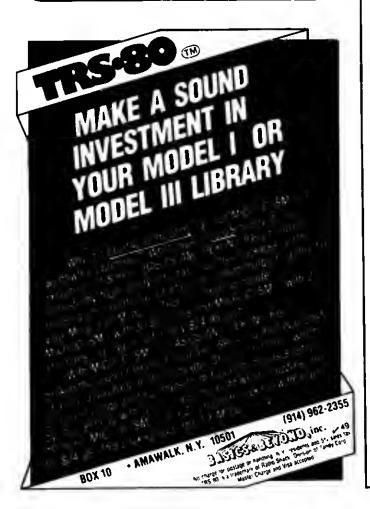
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Firestream

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o operate effectively, fire hose must be supplied with the right amount of water under the correct pressure. The TRS-80 Level II Basic program described here was created to calculate the tire engine pumping pressure needed to effectively supply water to a wide variety of firestreams. (The firestream is the entire water supply system, including the water source, the fire engine pump, the fire hose and the nozzle.) I constructed the program as a training tool for volunteer firemen.

The Firestream

Firestreams are defined in terms of their volume of water flow in gallons per minute (GPM), and the operational pressure of the nozzle in pounds per square inch (PSI). Operational pressure is the velocity of the water flowing through the fire hose. The

volume of water used is a function of the size of the fire hose and the pressure at which it is operating.

The type of fire hose nozzle used dictates the volume of water flow and the pressure which the firestream must supply. Pump operators must be able to adjust the outoing pressure of their pump to meet the requirements of the nozzles they are supplying with water. They are able to determine the correct pressure by knowing the characteristics of the firestream they are operating.

Nozzle Characteristics

Fog nozzles and solid stream nozzles are used in fire fighting. Fog nozzles produce fast moving jets of water that divide into drops with a definite cloud shape. They must be supplied with water pressure between 80 and 100 PSI. The volume of water put out by fog nozzles is determined by the design of the nozzle and the size of the fire hose to which it is attached.

The volume put out by solid stream nozzles may be calculated by the equation:

Nozzte Output (GPM) = 29.7 • D² • √P

D is the nozzle tip diameter in inches and P is the water pressure (PSI) at the nozzle.

Solid stream nozzles usually operate at pressures between 40 and 60 PSI.

Pressure Losses

Pressure et the nozzle end of the firestream is always less than that measured et the pump, due primarily to these three factors:

- The difference in height between the pump and the nozzle;
 The water flow resistance produced by valves and stream splitters (wyes);
- The friction between the water flowing through the hose and the walls of the fire hose. The fire engine pump operator must be able to calculate these pressure losses to correctly set the output pressure of the pump.

Pressure loss due to a difference in height between the pump and the nozzle usually happens when a fire occurs in the upper floors of a building. The pressure loss is one PSI for each 2.3 feet the water is moved above the pump. When pumping the firestream downhill, there will be a one PSI increase in pressure for each 2.3 feet difference in height.

If the firestream is split into two or more smaller streams with the use of a wye connection a pressure loss of 5 PSI is assigned for each wye in the firestream. To determine pressure losses due to friction the fire service uses 2½ inch diameter fire hose which is 100 feet long as the standard for calculation. To calculate the friction pressure losses in hoses with other diameters, determine the volume of water flow (Q) in hundreds of galions per minute:

The friction pressure loss per 100 feet of hose is then calculated by the equation:

$$FL = (2Q^2 + Q) - HF$$

HF is the fire hose diameter adjustment fector and FL is the friction pressure loss in PSI. The HF would have a value of 1.0 when the friction loss for 2½ Inch diameter fire hose is being calculated. The above equation is used when flow rates are greater than or equal to 100 GPM. If the flow rate in the firestream is less than 100 GPM, the equation for the calculation of the friction loss becomes:

This change in the equation is another adjustment for hose sizes less then 2½ inches in diemeter.

Once the friction pressure loss for 100 feet of fire hose has been calculated, the total fric-

tion pressure loss may be determined by multiplying the calculated friction loss by the total length of fire hose in the firestream and dividing by 100. Note that the friction loss of each different diameter fire hose must be calculated separately.

The total pressure loss in the firestream is the sum of the pressure losses for friction, height differences, and wye connections. After making the above calculations, the pump operator sets the pump output pressure for a value equal to the nozzle operational pressure plus the total pressure loss in the firestream.

Sample Problem

A fire is located about 20 feet

above the street on the third floor of a building. The fire engine is located at a fire hydrant 500 feet down the street. The firemen have used 600 feet of hose to reach the third floor. At the third floor the hose is split into two 150 foot long, 11/2-inch diameter hoses, with a 11/2 inch fog nozzle at the end of each of the hoses. The input into the computer program and the solution can be seen in Fig. 2.

This firestream would require a pumping pressure of 190 PSI to supply the two 11/2 inch fog nozzles with a pressure of 100 PSI. You can see how this program simplifies the calculation of a proper pumping pressure in various situations.

Firestream Program Listing.

```
18 CLEAR 1888:CLS:PRINT STRINGS(64,191)
28 DIM #S(7), HF(7), NS(5), NV(5,2), HT(3,2), CT(3,2)
38 PRINT TAB[21]; "VOLUNTER FIRE FIGHTER"; PRINT:PRINT TAB[18],""
48 FOR 1=1 TO 7:READ HS(1), HF(11:NEXT I
58 FOR I=1 TO 5:READ NS(1), HV(1,1), HV(1,2); NEXT I
68 PRINT:PRINT STRINGS(64,191):PRINT TAB(31); "BY":PRINT TAB(24),
"GEORGE L. GILLE":PRINT TAB[23); "VOLUNTER FIREMAN" (PRINT TAB(22), "MARYVILLE, HISSOURI":PRINT:FRINT STRINGS(64,191)
78 FOR I=1 TO 788:AS=INKEYS:NEXT I
88 CLS:PRINT*THE METHODS OF PIRE STREAM HYDRAULICS CALCULATIONS
AND DATA IN":PRINT*THIS PROGRAM WAS TAKEN PROM: ":PRINT
90 PRINT*INTERNATIONAL FIRE SERVICE TRAINING ASSOGIATION":PRINT*MANDAL NUMBER 281"
                    UAL NUMBER 281°
PRINT*FIRE SERVICE PRACTICES POR VOLUBTEER FIRE DEPARTMENTS*
   118 PRINT'FIFTH EDITION: 1971":PRINT:GOSUB 738
128 CLS:PRINT'PROGRAM DISCRIPTION:":PRINT"THIS PROGRAM CALCULATE
S THE ENGIN PRESSURE NECESSARY TO ALLOW"
138 PRINT'A FIRE STREAM TO OPERATE PROPERTLY. THE PROGRAM ASSUME
   139 PRINT'S THE STREAM TO OPERATE PROPERTLY. THE PROGRAM ASSURE S THAT": PRINT" THE FIRE STREAM IS SET UP AS A REVERSE LAY, WITH THE ENGIN AT 148 PRINT" THE ENGIN AT THE HYDRANT PUMPING WATER TO THE FIRE SCEEN OR": PRINT" PUMPING FROM A RESERVE TANK, "PRINT 158 PRINT" YOU ENTER THE TYPE OF FIRE STREAM, STARTING AT THE PUMPING "PRINT" ENGIN AND ENDING AT THE NOZZLE. THE FIRE STREAM MAY
     BE SPLIT
                     PRINT"WITH THE USE OF A WYE. ": PRINT
    168 PRINT"WITH THE USE OF A WYE.": PRINT
178 PRINT"ALL WYED PIRE STREAMS ARE ASSUMED TO END IN THE SAME T
YPE OF ": PRINT"NOIZLE": GOSUB 738
188 CLS: PRINT"ENTER THE DIFFERENCE IN ELEVATION BETWEEN THE ENGI
N AND THE": PRINT"NOIZLE OR NOIZLES IN FEET."
198 PRINT: PRINT NOIZLE OR NOIZLES IN FEET."
188 FEET. ": PRINT
268 INPUT DIFFERENCE IN ELEVATION (FEET) = "; EL: EL=EL/2.3
218 K-I: CLS: PRINT NOW WE BEGIN TO ENTER THE NATURE OF THE FIRE S
THEAM.": PRINT
228 PRINT"NOTE: THE FIRE STREAM IS RESTRICTED TO TWO WYE CONECTI
CON PRINT"NOTE: THE FIRE STREAM IS RESTRICTED TO TWO WYE CONECTI
   THEAM. :PRINT

228 PRINT NOTE: THE PIRE STREAM IS RESTRICTED TO TWO WYE CONECTI

ONS WITH:PRINT A MAXIMUM OF THREE PROGRESSIVE HOSE SIZES."

238 PRINT:PRINT SET'S BEGIN!!! :PRINT;GOSUB 739

248 CLS:PRINT STRINGS(64,148)

258 IF K-I THEN 288

268 FOR 1-1 TO (K-L):PRINT (HT(I,2)*188), FEET OF ";H$(HT(I,1))

78 FRINT STRINGS(63,148)

288 FOR 1-1 TO :IF K-I THEN 328

298 FOR I-1 TO 3

308 IF BTIJ:!) = I THEN 338

318 NEXT J
     318 NEXT J
328 PRINT" ";I," = ";H$(I)," HOSE"
338 NEXT I
     338 MEXT I
348 PRINT STRINGS(63,148):INPUT"ENTER THE NUMBER HOSE TYPE: ",HT
(X,I):PRINT:IP HT(K,I)>7 OR HT(K,I)<1 THEN PRINT"**** ERROR ****
"(COSUB 738;COTO 248
358 IF K-I THEN 398
368 FOR L-1 TO K-1:IF HT(L,I)>HT(K,I) THEN 3BB
378 PRINT"YOU ARE INCREASING NOSE SIZE!!!!!":PRINT:PRINT"PLEASE
ENTER AGAIN.":GOSUB 738:GOTO 248
388 MEXT L
      388 NEXT L
398 PRINT"ENTER THE PEET OF ";H$(HT(K,1));" HOSE":PRINT"IN THE F
      390 PRINT ENTER THE PEET OF "HS(BT(K,1));" NOSE: PRINT IN THE F

HRE STREAM.": FRINT

480 INPUT*FEET OF HOSE = ";HT(K,2):HT(K,2)-HT(K,2)/198

418 CLS:PRINT "ENTER TYPE OF CONNECTOR AT END OF THE ";HS(HT(K,1));" HOSE: ";PRINT "

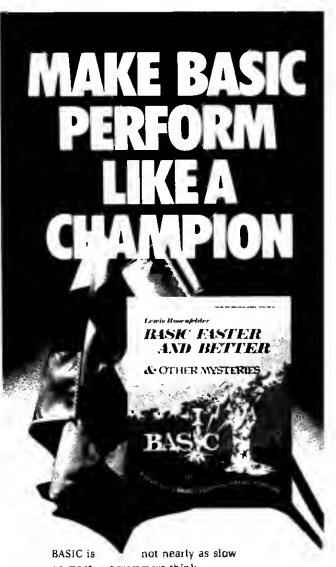
420 PRINT*NUMBER TYPE OF HOSE CONNECTOR*:PRINT STRINGS(64,148)

438 FOR 1=1 TO 5:PRINT" ";1;" = ",NS(1):NEXT I

448 PRINT STRINGS(64,148):INPUT*ENTER THE NUMBER OF THE CONNECTO

R TYPE ";CT(K,1):IP CT(K,1)>5 OR CT(K,1)<1 THEN PRINT**** ERROR
```

Program continues



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```
Program continued
 Program continued

****":GOSUB 736:GOTO 418

458 1F K=3 AND CT(K,1)=5 PRINT*MUST END IN A NOZZLE":PRINT*PLEAS
E ENTER AGAIN*:GOSUB 736:GOTO 418

466 1F K=3 THEN 468
478 1F CT(K,1)=5 THEN K=K+1:CLS:PRINT*ENTER NEXT HOSE":GOSUB 736:GOTO 248

486 1F CT(K,1)</h>
47 THEN 458
496 CLS:PRINT*PLEASE ENTER THE REQUESTED CHARACTERISTICS OF THE
SOLID STREAM*:PRINT*NOZZLE ON THE ";HS(HT(K,1));" HOSE.":PRINT*
506 INDUTENTER THE OPERATION PRESSURE OF NOZZLE IN P.S.I.";P
510 IF P>90 OR P<58 THEN PRINT**** ERROR *** PRESSURE OUT OF USU
AL OPERATION RANGE ***":PRINT*PLEASE RECONSIDER*:GOSUB 736:GOTO
498</p>
     520 INPUT"ENTER TIP DIAMETER IN INCHES AS A DECIMAL";D
530 Pl=SQR(P):GP=29.7*D*D*Pl:PRINT*NOZZLE FLOW RATE = ";GP;" G.P
.M.":GOSUB 730
    548 GOTO 568
   548 GOTO 568
558 P=NV(CT(K,1),1):GP=NV(CT(K,1),2)
568 WP=5*(K-1):Q=GP/188
578 G1=GP:GP=GP*({K-1)*2}:IF GP<=8 THEN GP=G1
588 FF=1:IF GP<188 THEN FP=8.5
598 FOR I=1 TO K
688 CT(1,2)=HF(HT(I,1))*({2*Q*Q}+FF*Q)*HT(I,2)
618 TL=TL+CT(I,2)
666 CT(I,2)=HF(HT(I,1))*({Z*Q*Q}+FF*Q)*HT[1,2)
610 TL=TL+CT(I,2)
620 NEXT I
630 EP=P+TL+WP+EL
646 CLS:PRINT*FOR OPERATION OF A ";NS(CT(K,1));" MOZZLE ";PRINT*
AT ";P;" P.S.I.";PRINT*MOZZLE FLOW = ";G];" GPM";PRINT*FIRE STRE
AM PLOW = ";Gp;" GPM"
658 PRINT*ENGIN PRESSURE REQUIRED = ";EP;" P.S.I.";PRINT;PRINT*F
RICTION LOSSES;";PRINT STRINGS(61,140)
660 PRINT* ELEVATION LOSS = ";EL;" P.S.I."
676 PRINT* WYE LOSS = ";WP;" P.S.I."
676 PRINT* "YE LOSS = ";WP;" P.S.I."
689 FOR I=1 TO K.
696 PRINT* ";(HT(I,2)*186);" FT. OF ";HS(HT(I,1));" = ";CT(I,2)
;" P.S.I."
786 NEXT I
718 GOSUB 730
728 GOTO 838
738 INPUT*<PRESS ENTER>";QS;RETURN
740 DATA "1 INCH RUBBER ",91,"1-1/2 INCH RUBBER LINED*,13
756 DATA "2-1/2 INCH RUBBER LINED*,1,"3 INCH RUBBER LINED*,8.385
    760 DATA "4 INCH RUBBER LINED", 0.09, "4-1/2 INCH RUBBER LINED", 0.
  851
779 DATA *5 INCH RUBBER LINED*,8.831
780 DATA *1 IN. HOSE FOG NOZZLE*,58,38
790 DATA *1-1/2 IN. HOSE FOG NOZZLE*,180,180
880 DATA *2-1/2 IN. HOSE FOG NOZZLE*,180,250
818 DATA *SOLID STREAM NOZZLE*,8,8
                     DATA "WYE",5,8
CLS:PRINT"MEMORY = ":MEM:END
```

HOW ACCEL2 WORKS

TRS-80 Model 1/III BASIC Compiler

ACCEL2 uses a novel translation technique that keeps code growth down and insures highest compatibility with BASIC source programs while giving huge speedups. Only a carefully chosen subset of BASIC instructions is translated. The non-compilable statements are left in the compiled program in their original source form and at run-time are actually given to the BASIC interpreter to execute. Program flow may flip into direct execution of the compiled machine instructions and then flop back to interpretation many times during execution. ing execution

Why Compilation improves performance

"Name Resolution: Term given to the process of identifying the value of a variable given its name. As a program runs, the interpreter builds a dictionary consisting of a chain of items each containing a variable name, data type and current value. Every time a variable is to be resolved the interpreter must sequentially search this dictionary. By contast, ACCEL 2 builds the variable dictionary once at compile time and thereafter can refer to the variable names by direct address, with no run-time search

*Line Resolution. The interpreter has to take the line number following a 6010 or 60SUB convert it to binary, and then search the program sequentially to find the target line. At compile-time ACCEL2 generates single machine instructions for 6010 or 60SUB using the actual address of the target line. For the interpreter, both name resolution and line resolution get slower as the program gets more complex, whereas for compiled code these two operations are independent of program size or number of variables.

*Computational Operations: The interpreter must parse each statement every time. Indithe one-byte codes that correspond to the operations. Took ahead to the next operator to establish the precedence rules and check for data type mismatch and conversion. Constants must be converted from character strings to internal binary. But under ACCE12 constants are converted and embedded right in the 280 instruction stream, and operations are translated once and for all at compile-time into sequences of calls to ROM or the run time component. INTEGER operations are actually turned into directly executing straight-line 280 code!

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With sound yet!

Hang Person



Photo 1.

Program Listing

```
' HANG-80
' BY: NATHAN HILTON
' USES 'SUPER SOUND' BY DAVID MORR
   ' SET MEM SIZE TO 32737 -16K RAM
' SUPER SOUND IS LINES 60-00, THEN "HANG-00"
60 CLS:AD=32730:HI=INT(AD/256):POKE16527,HI:POKE16526,AD-HI*256
70 FORI=AD TO AD+20: READ DT: POKE I,DT: NEXT 80 DATA 205,127,10,62,1,14,0,237,91,61,64,69,47,238,3,179,211,25
5,13,40,4,16,246,24,242,37,32,241,201
90 CLEAR300
100 DEFINTA-Z:DEFSTRZ:DIMSK(15):Q=256:RANDOM
110 QS=CHR$(191):S$=" ":AS=QS+STRING$(2,176)+Q$+S$+Q$+STRING$(2,
179) +Q$+S$+Q$+STRING$(2,131) +Q$+S$+Q$+CRR$(131) +STRING$(2,179) +S
$+STRING$(4,176)+$$+CHR$(1B6)+CHR$(179)+CHR$(107)+CHR$(144)+CHR$
(170)+STRING$(2,131)+CHR$(171)+STRING$(31,32)
120 A$=A$+Q$+" "+Q$+S$+Q$+" "+Q$+S$+Q$+" "+Q$+S$+Q$+STRIHG$(2
 176)+Q$+STRING$(6,32)+CHR$(101)+CHR$(176)+CHR$(184)+CHR$(149)+C
HR$(170)+STRING$(2,176)+Q$
13B B$="Welcome to :"
140 PRINT@460,"";:FORI=1T012:L=L+5:PRINTMID$(B$,I,1);:U=USR(Q+L)
:FORJ=1TO20:NEXTJ,I
150 FORI=1TO2:U=USR(Q*70+RND(30)+10):PRINT@460,STRINGS(12,32):FD
RJ=1TO200STEP5:T=USR((U/70)+J):NEXTJ:PRINT@460,BS:NEXTI
```

Program continues

Nathan Hilton 669 West Kitchen Port Neches, TX 77651

Tired of squeaky chalk boards and dusty fingers when playing hangman? Replace those noisy chalk boards with a CRT and far-out computer sounds. Now you and your computer can enjoy each other's company playing Hang-80 on the privacy of your own cathode ray tube.

Hang-80 gets its sound from a utility called Super Sound by David G. Morr (Mey 1980, 80 Microcomputing). This utility is easy to use and, with a little imagination, makes great sounds.

Sound

You need a small audio amplifier to hear the sound which comes out of the cassette output plug of your TRS-80 microcomputer.

Before you do any programming, answer your computer's memory size question with 32737 (16K machines). This allows Super Sound to be loaded into the top of RAM undisturbed.

Super Sound is found in lines 60-80. Line 60 sets the USR address. Line 70 reads and POKEs the data in line 80 Into the top of RAM. Line 80 is the data for the Super Sound utility. Every time you see a USR(), a sound will be produced.

The Program

With the exception of e gap here and there, you can Auto all the way through the program, making program typing a little easier. Furthermore, etter you type Run and hit Enter, you can forget the Enter key because you won't need it during the game.

Here is how Hang-80 works: In line 100, variables A through Z are defined as integers. Lines 110 and 120 create the opening block letters that are assigned to A\$. Lines 130-200 create letters and sounds.

Lines 3110–3140 are data lines containing the instructions. The loop in line 240 reads the data so lines 260 and 270 can conveniently read and print the instructions with flying sounds.

From 610 we GOSUB 2000. This is where the computer picks the word for you to guess at. Then we return and GOSUB 5000.

"You can count the words you enter yourself or let the computer count them for you."

Lines 5000-5070 simply set up the pleying screen.

Program continued

Lines 630 and 640 put the spaces on the screen. Lines 660 through 780 process the entries and put the letters in the mystery word.

The first 29 data elements are the machine code numbers for Super Sound. The next 514 data elements are the words the computer picks from for the player to guess. Finally, there are the 14 lines of instruction. There is a total of 557 elements of data.

There is an alternative to typing 557 chunks of data. Leave the first 29 data elements alone. However, you can do what you want with the next 514.

You can use a different number of words as long es you make some number changes in lines 240 and 2050.

The number 543 in line 240 must be changed to account for the number of words you enter into the data lines. Simply add your number of words to 29 end enter that number in place of 543.

in line 2050 change the RND (514) to read RND (your number of words) after the change.

Counting

You can count the words you enter yourself or let the computer count them for you. I tound it easier to let the computer do the counting.

After entering the program, execute the tollowing line: RESTORE:FOR A=1 TO 29:READ D\$: NEXT A (enter). This gets you past the Super Sound so the next Read statement will read the first vocabulary word. Now execute the following line and remember to use Shift @ to freeze the display when necessary: FOR A=1 TO 1000:READ D\$:PRINT A:D\$: NEXT A.

Whenever you see "Welcome to Hang-80" pop up, hit the Break key to get out of the loop. Now look at the last word printed; it has a number to its left. That number is the number of words you now have in the computer's vocabulary.

How to Play

When Hang-80 is run, you must answer a few questions the computer will askyou. The playing screen will appear and you will have all the information you need to play the game. Printed at 797 you will see a row of spaces with a flashing arrow to the left of them. The spaces are actually a row of cursors. The number of the CHR\$(95)s in the row is the number of letters in the word you are to guess at. All you do is hit a letter and the computer will put it in the row of spaces if the letter you hit is contained in the word. Otherwise it is counted as a wrong guess. You lose when you don't have any wrong guesses left.

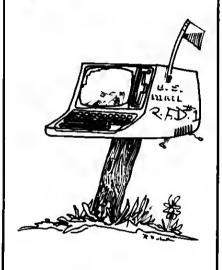
```
160 FORI=1T070STEP5:U=USR(O*I+RND(30)+5):FORX=1T050/I:NEXTK,I
170 PRINT0394,A$
100 FORI = 255TO0STEP-5: F=F+5: U=USR(Q+I): U=USR(O+F): NEXTI
190 F=0:FORL=1TO3:FORI=100TO1STEP-2:F=F+L:U=USR(Q+I):U=USR(Q+F):
NEXTI: F=0: NEXTL
200 FORG=25TO100STEP25:FORI=1TO30:U=USR(Q+G):NEXTI,G
210 RESTORE:PRINT0760,"Do you want instructions?"
220 W$=INKEY$:U=USR(Q+RND(5)+30):IFW$<>"Y"ANDW$<>"N"ANDW$<>"Y"AN
ONS<>"n"THEN220ELSEIFWS="Y"ORNS="y"THEN230ELSE400
230 CLS:U=USR(Q*100+255)
240 RESTORE: FORA=1TO543: READD$: NEXT
250 FORA=20 TO 33
260 READDS:PORB=1TOLEN(D$):PRINTMID$(D$,B,1);:U=USR(Q+35+RND(3))
:FORG=1TO3:NEXTG,B:U=USR(Q+5)
270 PRINT: NEXTA
200 PRINT@960,"BIT <9> TO CONTINUE";
290 PRINT@965," ";:FORA=1TO5:Z=INKEYS:U=USR(Q+30):IFZ<>"9"TREN N
EXT ELSE 340
300 PRINT@965, "9";:FORA=lTOl0:IFZ<>"9"THEN NEXT ELSE340
310 V=V+1:IF V>1000THENV=0:GOTO310: ELSE IF INT(V/4)=V/4 THEN 32
ØELSE 290
                                                          ";:GOTO290:ELSE PRINT@9
320 IF PEEK(16320) <> 32 THENPRINT@960, "
60, "HIT":: GOTO290
340 CLS
400 K=640:PRINT:PRINT:PRINT:PRINT*Well you pick a (1) - easy*(re litive) ":PRINTTAB(17) "(2) - a little more difficult";CBR$(31) 410 PORI=1TO2:E$=INKEY$:IFE$<>"1"ANDE$<>"2"THENNEXTELSEIFE$="2"T
HENDF=0:GOTO500:ELSEDF=3:GOTO500
420 U=USR(Q+40):PRINT@K,CHR$(191);:K=K+1:IFK=1022CLS:PRINTCNR$(2
3) "Hurry upl": GOTO400ELSE410
500 IFDF=3 THEN G$="EASY" ELSE G$="NOT SO EASY"
610 CLS: GOSUB2000
620 CLS:GOSUE5000:G$=""
630 PRINT@797, "";:LG=LEN(W$):FORA=1TOLG:U=USR(Q+A*2)
640 PRINTCHR$(95);:NEXT
650 N=RNO(3)+2+INT(LEN(H$)/2)+OF:M=0
660 IF LG=0 THEN7000: FORA=1 TO RND(10)+20: Z=INKEY$: IFZ=""THEN NE
670 PRINT@785," ";:U=USR(Q+RND(5)+30)
600 FORA=1T030:Z=INKEY$:IFZ="THENNEXTELSE700
690 PRINTE785, CHR$(94)::U=USR(Q+RND(5)+30):GOTO660
700 IF (Z<"a" OR Z>"z") AND Z<>"9" THEN FOR A=100 TO 1 STEP-10:U
 =USR(Q+A):NEXT:GOTO660:ELSEIFZ="9"THENCLS:U=USR(Q*75+44):CLS:RES
 TORE: GOTO210
 730 FOR A=1 TO LEN(G$) STEP 2: IF MID$(G$,A,1) <> Z THEN NEXT:N=N-
 1: GOTO740:ELSE PRINT0520,STRING$(27,32);:U=UBR(Q*127+255):PRINT
0520,CHR$(92); LETTERS ALREADY GUESSED ;CHR$(92);:GOTO660
 740 M=M+3
 750 GOSUB1000:FOR A=1 TO LEN(W$):PRINT@060+A,Z;:FORK=1TO3:NEXTK:
PRINT@0604A," ";:IF NOT MIDS(NS,A,1)=Z THEN HEXTA ELSE FOR@=1TO 5:PRINT@796+A," ";:IF NOT MIDS(NS,A,1)=Z THEN HEXTA ELSE FOR@=1TO 5:PRINT@796+A," ";:PRINT@796+A,Z;:FORG=1TO5:U=USR(Q+ASC(Z)):NEXT G:PRINT@796+A," ";:NEXTBB:PRINT@796+A,Z;:LG=LG-1:N=N+1:NEXTA 760 G$=G$+Z+" ":PRINT@420,N:IF N=0THENGOSUB4000: FORA=1TO3:PRINT@385,STRING$(23,32);:U=USR(Q*100+50):PRINT@385,"* OF WRONG GUESE ES LEFT";:U=USR(Q*100+50):NEXTA:FORY=47TO0STEP-2:FORX=0TO127STEP
 9: SET(X,Y): NEXTX: U=USR(Q+Y): NEXTY: GOTO9000
 770 PRINT@576,G$;
 780 PRINT @300, M; : GOTO 660
 1000 FOR A=16157TO16157+LEN(W$): IF PEEX(A) = ASC(Z) THENGOTO660ELSE
  NEXT : RETURN
 2000 CLS:FORA=1T060STEP10:FORL=20T01STEP-5:FORR=1T00STEP2:U=USR(
 Q+R+L+A::MEXTR,L,A:PRINT*Nould you like the words*:PRINTTAB(5)*(1) - five letters and under*:PRINTTAB(5)*(2) - six letters and ove
 2010 U=USR(Q*10+100):FORA=1TO40:Z=INXEYS:IF Z<>"1"ANDZ<>"2"AND Z<>"3" THENNEXTELSE2030
 2020 U=USR(Q+50): FORA=1TO30:Z=INKEY$:IF Z<>"1"ANDZ<>"2"AND Z<>"
 3" THENNEXT:GOTO2010:ELSE2030
2030 IFZ="1"THEN U=USR(Q*100+44):L=5 ELSE IFZ="2"THEN U=USR(Q*10
 0+44):FORA=1TO20:NEXT:U=USR(Q*100+44):L=6 ELSE L=0:FORA=1TO3:U=U
 SR(Q*100+44):FORB=1TO20:NEXTB, A
 2040 CLS:RESTORE:FORA=1TO29:READD$:NEXT
2050 W=RND(514):PRINT@455, ONE MOMENT PLEASE*
  2060 FORA=1TOW: READ WS: U=USR(Q+A): NEXT
```

Program continues

101 USES FOR A DEAD MICROCOMPUTER no.34



no.80



no.96



Program continued

2070 IF L=5 THEN IF NOT LEN(W\$) <=5 THEN FORA=10TO1 STEP-1:U=USR(Q+A): NEXT: GOTO2848 2000 IF L=6 THEN IF NOT LEN(W\$)>=6 THEN FORA=10TO1 STEP-1:U=USR(Q+A): NEXT: GOTO 2040 2090 RETURH 2900 DATA actinium,aluminum,americium,antimony,argon,arsenic,ast atine,barium,berkelium,beryllium,bismuth,boron,bromine,cadmium,c alcium, californium, carbon, cerium, cesium, chlorine, shromium, cobalt copper, curium, dysprosium, einsteinium, erbium, europium 2910 DATA fermium,fluorine,francium,gadolinium,gallium,germanium gold, hafnium, helium, holmium, hydrogen, indium, iodine, iridium, iron, krypton, lanthanum, lawrencium, lead, lithium, lutetium, magnesium, man ganese, mendelveium, mercury, molybdenum, neodymium, neon 2920 DATA neptunium, nickle, niobium, nitrogen, nobelium, osmium, oxyg en,palladium,phosphorus,platinum,plutonium,polonium,potassium,pr aseodymium, promethium, protactinium, radium, radon, rhenium, rhodium, rubibium, ruthenium, samarium, scandium, selenium, silicon 2930 DATA silver, sodium, strontium, sulfur, tantalum, technetium, tel lurium, terbium, thallium, thorium, thulium, tin, titanium, tungsten, ur snium, vanadium, xenon, ytturbium, yttrium, zinc, zirconium 2940 DATA inconspicuous, inconstant, individually, indifference, inf orm, inject, insufficient, insulate, invasion, jam, jail, jeep, jelly, ju nk,knock,knot,knapsack,knowledge,know,known,koala 3000 DATA amazment,amandment,amoeba,amplify,amulet,amuse,adjust, action, address, acknowledgement, accident, ace, apologize, bronco, bro nze,bristle,brook,brood,bump,bee,bunt,cactus,caboose,caddie,cand , cap, capacity, cape, center, cellophane, celebration 3010 DATA centenial, clank, civilization, circus, clamber, clammy, cla m, circulatory, citizenship, city, claim, clot, cloth, close, clock, clin k,click,climb,clever,clothes,compound,complete,complaint,compile compassionate, compete, comprehension, cat, condor, coon 3020 DATA convent, coo, cook, cooler, cool, cookie, convert, crunch, cru sh,crust,cuckoo,cue,cultivate,daunt,dead,deadly,dear,death,deal, dean, dealt, delve, demand, delete, dice, different, difficult, dig, digg er, discord, discolor, dirty, down, draft, drain, drag, eel 3030 DATA electric, electromagnet, electricity, ell, elk, elves, elf, element, entry, enter, equal, exalt, extend, explode, extra, express, fan, farewell, farm, fat, fate, fasten, father, fashion, fit, fist, flake, flag fission,fork,fussion,geophysical,genie,germ,get,good 3040 DATA habit, hailstone, hairpin, hall, halfway, hamster, hammock, h ammer, handbag, handful, handle, happiness, hardware, harmony, harvest, haunted, helicopter, hold, hypocritical, identification, idle, igloo, i gnite, ill, imp, impact, imperial, impossibility, inch, indeed, indent 3050 DATA lump, lug, low, lurk, lull, luck, match, mop, material, melt, me sh,minnow,mirror,mint,mystery,nag,new,news,never,nickel,open,ope

rate,ounce,other,our,oven,over,page,pale,palm,patch,patrol,peril perfect, perk, perplex, pig, picture, piano, pierce, pigoen, piece, pie 3060 DATA pliers, plow, plum, plug, plod, plot, ply, post, potent, potato ,probe,pro,proceed,professor,product,public,puff,pulp,puls,pulle y,quick,quilt,quite,quicken,quiz,rabbit,race,ray,reach,realm,rea read, refract, regular, request, run, rule, ruler, rug 3070 DATA rung, scan, scheme, scat, scare, scar, set, sea, setter, sew, sh ock,shook,shoe,shot,short,shore,silk,signature,significance,simp ly, simplify, skid, sketch, size, skate, sky, sole, soft, soda, softball, s pook, splash, spoke, splatter, splinter, spontaneous, spoon 3000 DATA spoil, sport, stalk, stand, star, stamp, standard, stone, stor m,stock,etocking,stockholder,stomach,stop,stork,stun,sub,subject , subscribe, submit, submarine, sweat, sweep, sweet, swell, swim, swimmer ,swift, terror, terrific, terrible, than, thanks, timber 3090 DATA tomb, ton, told, tone, tooth, tonic, top, trailer, train, traff ic, tramp, translate, translation, transformer, transistor, trip, trim, trot, troop, triumphant, trouble, unbend, unbound, uncommon, uncomforta ble,uncle,under,understand,uphold,upkeep,us 3100 DATA urban, verb, vein, watt, wave, way, wax, we, wear, weak, water, w idth,wick,wig,will,wild,word,wonderful,wolf,wood,wooden,woodman, woodcraft,wool,woolen,write,wrong,wry,xylophone,yam,yacht,yap,ya rd, year, yarn, yellow, yong, zeal, zone, zero, zipper
3110 DATA "WELCOME TO HANG-00!!"," I will think of a word and
you will guess it one", "letter at a time.", "I will display som e spaces that will represent the word you are to guess.", "The nu mber of spaces is the number of letters in the word."
3120 DATA "You simply hit a letter, and if it is in the word I",
" am thinking of, I will put it in the proper place"," in the ro w of spaces. 4000 FORA=16157TO16157+LEN(W\$):SK(A-16157)=PEEK(A):NEXT:RETURN

5000 PRINTTAB(0),A\$; 5010 PRINT@155,G\$;

Program continues

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Program continued

5020 PRINT@257, "# OF GUESSES MADE", CHR\$ (94);

5030 PRINT0305,"# OF WRONG GUESSES HADE", CHR\$(94);
5040 PRINT0305,"# OF WRONG GUESSED LEFT", CHR\$(94);
5040 PRINT0520, CHR\$(92); LETTERS ALREADY GUESSED "; CHR\$(92);
5050 PRINT0760, WORD TO GUESS --"; CHR\$(94);
5060 PRINT0960, FOR NEW GAME HIT <9<";

5070 RETURN

7000 PRINT@797, STRING\$(LEN(W\$),32);:FORA=1TO20:U=USR(Q+RND(10)+2 5):NEXT

7010 PRINT@797, "";: FORA=1TOLEN(W\$): PRINTMID\$(W\$, A, 1);: FORL=1TO10 STEP5: FORT = 20 TO1 STEP-5: U=USR (Q+T+L): NEXTT: U=USR (Q+L): NEXTL: U=USR

(Q+10+A):NEXTA 7020 IF V=1 THEN 7030 ELSE V=1:FORA=1TO2:PRINT@797,STRING\$(LEN(W \$),32);:FORT=1TO20:U=USR(Q+T):NEXTT:PRINT0797,W\$;:FORT=1TO20:S=U

FORY=20TO0STEP-10:U=USR(Q+Y+G+T):NEXTY:U=USR(Q+G+T+A):NEXTG:U=US R(Q+T): NEXTT: PRINT@390, STRING\$(LEN(A\$), 32); : FORS=1TO5: U=USR(Q+S+

A):NEXTS,A
9010 QS="THE WORD WAS ----- "+W\$:PRINT@450,"";

9020 FORA=1TOLEN(Q\$):PRINTMID\$(Q\$,A,1);:U=USR(Q+20):PORS=1TO4:NE XTS,A

9030 Q\$="YOU LOSE AND - - - - - - - "+CHR\$(162)+CHR\$(183)+ "+CHR\$(181)+CHR\$(180)+CHR\$(149)+CHR\$(149)+CHR\$(151)+CHR\$(171)

9040 FORA=120+LEN(Q\$)TO120STEP-1:PRINT@A,MID\$(Q\$,A-127,1);:U=USR (Q+A-50): NEXT

9050 PRINT0704,""

9060 QS="WHEN YOU MADE TOO MANY WRONG GUESSES,":FORA=1TOLEN(Q\$):

PRINTMID\$(Q\$,A,1);:U=USR(Q+60):NEXT
9070 Q\$="YOUR "+CHR\$(34)+"PART WORD"+CHR\$(34)+" LOOKED LIKE"+CHR

9000 PRINT: FORA=1TOLEN(Q\$): U=USR(Q+A): PRINTMID\$(Q\$,A,1);: NEXT

9090 FORA=16157TO16157+LEN(W\$)

9100 POKEA, SK(A-16157): U=USR(Q+A): U=USR(Q+RND(20)): NEXT 9110 GOTO250

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A Tale of Two Drivers

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have developed two printer driver patches, one for Level II Basic, operating under either TRSDOS or Basic, the other for NEWDOS's EDTASM. The patches heve the following features: They output a line feed after a carriege return (to enable printers requiring this feature), provide for an automatic form feed after a given number of lines and enable the user to output a topof-form from the keyboard. An additional feature, to be used with EDTASM, is a pege header printed with the date end page number.

Hardware or software may be used to cause a line feed on a carriage return. Either solution will work equally well, but software is simpler and less expensive.

Program Listing 1 is a predriver (executed before ROM printer driver) for Level II Basic end TRSDOS or NEWDOS. This program is loaded into the upper end of memory and must be protected. To capture the printer driver, which is called from ROM by the various Level II and DOS print commands, change the address of the printer driver by modifying the printer Device Control Block (DCB). The DCB is located at 4025H-402CH, and the printer driver's Least Significant Byte (LSB) is at 4026H, the Most Significant Byte (MSB) is at 4027H.

By altering the printer driver eddress in the DCB, program control is diverted to the predriver, lines 27-61. The address in the DCB is changed by the initialization section of the progrem. (Note: Readers not using

```
Program Listing 1
                  00003
                                               PATCS/TXT
                  98884
                                           PRINTER PATCE FOR (LF) AFTER (CB)
                  00005
                                                          VERSION 1.8
                              BY JOSN BLAIR WA40BZ & TON THOMPSON
                  60009
                  00011
                                                          INITIALIZATION
                            THIS SECTION LINKS THE RON PRINTER DRIVER ROUTINE WITH THIS PROGRAN. ALSO THIS SECTION WILL GENERATE A PRITECTION OF THIS PROGRAM TO DOS AND BASIC. THEN
                  99912
                  69913
                   66914
                             RETURN TO DOS.
                  00016
PERR
                                                                    ; SOME OOS'S REQUIRE THE : TOP 128 GYTES OF MEMORY
                  00017
                                     ORG
                                               RECORN
                  00010
PEBB
                  00020 INIT
                                     EQU
FERR 210FFE
                                               SL, START
                  00021
                                     LD
££83 228248
                                                (4802B),NL
(4806B),NL
                  00022
                                     LO
                                                                     SET PROTECTED MEMORY
£896 22D646
                                     LD
                  00023
228A9P
                                                                       LINK PATCE TO PRINT OCE
                                                (4826), BL
                                                4820B
288C C32048
                  00025
                                                                     ; RE-ENTER DOS
                  99926
                                                PATCS
                  99927
                                                                                          Program continues
```

disk should change line 22 to: LD(40B2)HL. This automatically sets protected memory for disk users. The address of the jump instruction in line 38 must be changed from 402DH to 1A19H, the warm start for Level II Basic)

Pre-driver operation is quite simple: It checks the character to be printed. If it is not a carriage return, control is given back to Radio Shack's printer driver, located at 058DH. If the character is a carriage return, lines 42-45 output the line feed directly to the printer and increment the line counter. When the line counter indicates 54 lines have been printed, the pre-driver executes lines 53-58 to generate a form feed.

Willful Form Feeds

The last feature resets the line-per-page counter, and put-puts a form feed at will. The shift @ sign, a printable character with no meaning as a Basic command, is used for this purpose. After a listing has tinished, the last page is usually almost filled. Enter LPRINT shift @ to reset the counters and top-of-form and to get the page out of the printer. This keeps the printer's counters and the software counters in sync.

If your printer does not accept a form feed, 0CH, use the optional form feed routine shown in Program Listing 3. Those using Level II must protect memory on power up, then load the object program using the System call. After the program has loaded, enter a slash to execute the initialization that links the pre-driver to Basic.

Readers using disk should put this in the automatic boot file on disk. This will cause the line feed on the carriage return patch to be booted every time the DOS is booted. You may now use all DOS and Basic commands that send output to the printer.

Page Headers for EDTASM

Program Listing 2 is a modification of Apparat's NEWDOS Plus EDTASM. The program provides: a line feed on carriage return; a way of resetting the counts and giving a form feed; a

```
Program continued
                  00029 ;
                                 THIS SECTION IS A PRE-DRIVER THAT ALLOWS A
                           LINE-FEED UPON DETECTION OF A CARRIAGE RETURN. IT ALSO WILL GENERATE A FORM-FEED AFTER THE DETECTION OF THE 54TH CARRIAGE RETURN. A SPECIAL CHARACTER OF A SBIFT , USING THE LPRINT "(SHIFT) @" COMMAND FROM
                  00031
                  00032
                  00033
                           BASIC WILL RE-SET ALL COUNTERS AND GIVE A TOP-OF-FORM.
                  00034
                  99935
  PERF
                  00036 START EOU
  FEØF 79
                                          À,C
                                                            GET CHAR TO BE PRINTED
                  00037
                                 LD
   FE10 FE60
                  00038
                                  CP
                                           60H
                                                            ; IS IT A SHIFT
                                                            ; OUTPUT (FF)
                                           Z,FRMFED
  FE12 2022
                  00039
                                  JR
                                                                    (CR) ?
                  99949
  FE14 FE00
                                  CP
                                           BOH
                                                            ; IS IT
                                                                  GOTO PRINTER DRVR
                                  JΡ
                                           NZ . 0500H
        C28D85
                  00041
  FE16
  FE19 CDD105
                                           0501H
                                                            PRINTER STATUS CHECK
                  00042 LF
                                  CALL
   FEIC C219FE
                  00043
                                  JP
                                           NZ, LF
  FE1F 3E0A
FE21 32E837
                                                            :SET OUTPUT CHAR = (LF)
                  00044
                                  LD
                                           A, ØAH
                                           (37E0H).A
                                                            OUTPUT CHAR
                  00045
                                  LD
                                  LD
                                                            GET LINE COUNTER
   PE24 DD7E04
                  00046
                                           A,(IX+04)
                                                            ;54 LINES YET ?
   FE27
        FE35
                  00047
                                  CP
                                           53ò
                                           NZ,EXIT
05DlH
                                                            ; NO. OUTPUT <CR>;GET PRINTER STATUS
   FE29 C245PE
                  00040
                                  JP
   FE2C C00105
                  00049 CR
                                  CALL
        20FB
                  00050
                                  JR
                                           NZ,CR
   FE2F
                                                            ;OUTPUT CHAR = <CR>
;OUTPUT LAST <CR>
   FE31 3E0D
                  00051
                                  LD
                                           A, ODN
                                           (37E0H),A
   FE33 32E837
                  00052
                                  I.D
                         FRMFED
                                                            PRINTER STATUS ?
                  00053
   PE36
        CD0105
                                  CALL
                                           05D1H
   FE39
        20F8
                  00054
                                  JR
                                           NZ, FRMFED
   FE3B 3EOC
                                                            ; SET OUTPUT CHAR = <FF>
                  00055
   FE3D 32E837
                  00056
                                  LD
                                           (37E0H).A
                                                            :OUTPUT CHAR
                                           (IX+04),00
                                                            RESET LINE COUNTER
   FE40 DD360400
                  00057
                                  ת.ז
   FE44 C9
                                  RET
                  00050
                  00059
                  00060
   FE45 C38D05
                         EXIT
                                  JΡ
                                           050DH
                                                            :OUTPUT <CR>
   FFGG
                  99961
                                  END
                                           THIT
   99999 TOTAL ERRORS
      00100 :********
                 00110 ;*
                        ; *
                 00120
                                            OPTIONAL.
                                                        'FORM FEED' ROUTINE
                 00130
                 00140
                 00150
                 00160
                 00170
                        00180
                                                                                            S
                 00190
                                  NOTES:
                 00200
                                  1)
                                        THIS CAN REPLACE THE SECTION OF THE
                                                                                            S
                                     FORM FEED ROUTINE THAT OUTPUTS THE OCH.
                 00210
                                                                                            S
                                   THE REFERENCE COUNTER (IX+03) IS 67 LINES / PAGE. THIS CAN BE CHANGED BY
                 00220
                                                                                            S
                 00230
                                                                                            Ś
                 00240
                                  POKING THE VALUE DESIRED, OR BY ADDING:
                                                                                            S
                 00250
                                            HL,4020H
                 00260
                                            (HL),XX
                 00270
                          $
                                  WHERE XX = THE # OF LINES/PAGE DESIRED
                 00200
                                  INTO THE INITIALIZATION ROUTINE
                 00290
                 00300
                        00310
                 00320
0000 DOE5
                 00330
                                  PUSH
0002 CD9F05
                 00340
                                            059FH
                                  CALL
                                                               FINE # LINES LEFT ON
                 00350
                                                               ; PAGE, AND OUTPUT AS
                                                               ; <LF > 'S.
                 00360
0005 DD3405
                 00370
                                  INC
                                            (IX+05)
                                                               ; INC PAGE COUNTER
9999 DDE1
                 00300
                                  POP
                                            IX
                                                               : INC PAGE COUNTER
                 00390
                 99499
                                  END
                                                     DELETE THIS LINE
00000 TOTAL ERRORS
```

```
Program Listing 2
00100 ;*
00110
00120
                   ASNPTCH/TXT
00130
88140 ;*
             PRINTER PATCH FOR (LF) AFTER (CR)
00150
                        AND
00160
                   FOR NEWDOS'S DISK BASED EDTASM
00170
00100
             JOHN BLAIR & TON TROMPSON
00190
00200
99218 ;********* DEFINATION OF LABLES ********
                                                             Program continues
```

method to title end number a page; and inserts the date in the header.

This program will be edded to the end of EDTASM. All references to the beginning of the text buffer must be changed to the new beginning of the buffer, the function of lines 350-600.

Generating a line feed after a carriage return is easiest. Since NEWDOS makes use of a ROM call to access the printer driver, we need only change the address of the printer driver by modifying the printer Device Control Block (DCB). This is done in the initialization section. The printer driver's address is altered and program control is diverted to the pre-driver, lines 610-1840. This section of the program checks the character to be printed to determine if it is a carriage return. If not, control is given back to ROM's printer driver located at 058DH. If the character to be printed is a carriage return, the pre-driver outputs the character: lines 850-910 output the carriage return directly to the printer. Lines 930-1040 output the line feed, increment the line counter and check to see if 54 lines have been printed. If not, the character to be printed (carriage return 00H) is restored, and the predriver returns control to ED-TASM. When 54 lines have been printed, the pre-driver executes lines 1060-1150 to generate a form feed.

There are two methods of generating a form feed. The first has the printer accept the ASCII form feed command, a 0CH. The pre-driver outputs a 0CH directly to the printer, then resets the line counter, increments the page counter and calls the routine to print the page headers. The second method is to call the form feed routine from ROM, which outputs line feeds by replacing lines 1090-1150 with the alternate form feed routine (Program Listing 3).

Printing the page header information is more complex (lines 1380-1840). First, the header message is printed by the OUTSTR subroutine, then the page number is printed. The OUTSTR routine requires that the HL register contain the ad-

25888 7488 84829 7481 40588 37E8 37E8 37E8 38503 38503 38503 38118 38787 1 87707 1 88787 2 88838 84187 1 87707 1 88787 2 88839 84187 2 88839 84187 8	18876 18876 18876 18876 18876	80360 90370; 90380; 80390; 80400 60410 90420 90440 90440 90440 90440 90470 90460 90470 90460 90470	PNSG EOU IST EQU IST EQU INT E	SECTION REPLACES NG OF TEXT BUFFER NG OF TEXT BUFFER 8118H HL,DONE-OFFSET 838AH HL,DONE-OFFSET	
7488 8080 8080 7481 7482 7482 8037 8037 8037 8033 8038 8038 8038 8038	18876 18876 18876 18876 18876	90240 APR 90250 ASN 90250 ASN 90260 PAC 90280 PAC 90320 PR 90310 ST 90320 VII 90330 PR 90330 PR 90330 PR 90340 ; 90440 90440 90440 90440 90440 90440 90440 90440 90440 90440 90440 90440 90440	PNSG EOU IST EQU IST EQU ICNT EOU IL EQU ICNT EQU INT EOU INT	9F80H-OFFSET 5500H-OFFSET 5500H-OFFSET 4029H APPMSG+1 402AH 0550H 0531H 0633H 580AH TART OF BUFFER IN SECTION REPLACES NG OF TEXT BUFFER 8118H HL,DONE-OFFSET 838AH HL,DONE-OFFSET	;START OF RELOC. ASM2;LINE/PAGE COUNTER ;PAGE • COUNTER ;PAGE • COUNTER ;PRON PRINTER DRIVER ;PRINTER ADDRESS ;ROM PRINTER STATUS CK. ;ROM VIDEO DISPLY ;REENTRY TO ASM2 N EDTASM WITH NEW BEG •• ALL EDTASM REFERENCES TO R WITH THE BEGINNING OF THE R.
88889 4821 4821 4821 4821 4821 4821 4821 8831	18876 18876 18876 18876 18876	99258 ASP 99268 LIN 99278 PA 99298 PR 99399 PR 99329 VI 99329 VI 99338 WAN 99349 PR 99369 PR 99379 PR	AST EQUICAT EQUICAT EQUICAT EQUICAT EQUICATUS	5588H+OFPSET 4829H APPMSG+1 482AH 858DH 37E8H 85D1H 8833H 58DAH TART OF BUPPER IN SECTION REPLACES NG OF TEXT BUFFEI RO OF TEXT BUFFEI 8118H HL, DONE-OFFSET 838AH HL, DONE-OFFSET	;START OF RELOC. ASM2;LINE/PAGE COUNTER ;PAGE • COUNTER ;PAGE • COUNTER ;PRON PRINTER DRIVER ;PRINTER ADDRESS ;ROM PRINTER STATUS CK. ;ROM VIDEO DISPLY ;REENTRY TO ASM2 N EDTASM WITH NEW BEG •• ALL EDTASM REFERENCES TO R WITH THE BEGINNING OF THE R.
4629 7482A 9582B 9	18876 18876 18876 18876 18876	90266 LIM 00270 MS 00280 PR 00300 PR 00310 VII 00330 WAI 00350 ;** 00360 ;**	NCNT EOU I EQU GCNT EQU INT EQU INT EQU ATUS EQU DEO EOU RMST EQU ** REPLACE S THIS THE BEGINNI ORG LD ORG LD ORG LD	4829H APPMSG+1 482AH 858DH 37E8H 85D1H 8833H 58DAH TART OP BUPPER IN SECTION REPLACES NG OF TEXT BUFFER 8118H HL, DONE-OFFSET 838AH HL, DONE-OFFSET	;LINE/PAGE COUNTER ;PAGE * COUNTER ;RON PRINTER DRIVER ;PRINTER ADDRESS ;RON PRINTER STATUS CK. ;RON VIDEO DISPLY ;REENTRY TO ASM2 N EDTASH WITH NEW BEG ** ALL EDTASH REFERENCES TO R NITH THE BEGINNING OF THE R.
402A 958E8 959E8 969E3 969E3 969E3 969E3 979	18876 18876 18876 18876 18876	00286 PAC 00286 PRI 00390 PRI 00310 ST/ 00320 VII 00338 WAN 00340 90370 ; 00300 ; 00300 ; 00300 ; 00440 00440 00440 00440 00440 00440 00440 00440 00480	GCNT EQU INT EQU INT EQU INT EQU INT EQU ATUS EQU DEO EOU RMST EQU RMST EQU RMST EQU RMST EQU ORG LD ORG LD ORG LD	482AH 858DH 37E8H 85D1H 8833H 58DAH TART OF BUPPER IN SECTION REPLACES NG OF TEXT BUFFEI NG OF TEXT BUFFEI 8118H HL, DONE-OFFSET 838AH HL, DONE-OFFSET	; RON PRINTER DRIVER ; PRINTER ADDRESS ; RON PRINTER STATUS CK. ; RON VIDEO DISPLY ; REENTRY TO ASM2 N EDTASN WITH NEW BEG ** ALL EDTASM REFERENCES TO R NITH THE BEGINNING OF THE R.
9580 8 3780 1 3780 1 9933 3 8830 4 8118 2 8138 4 8410 1 8700 2 88410 1 8700 2 88539 2 88839 2 88839 2 88839 2 88839 2	18876 18876 18876 18876 18876	88296 PR 88300 PST 98310 VI 98338 WAS 88358 ;** 88360 98380 ;** 88390 ; 88390 ; 88390 ; 88400 98428 98440 98428 98440 98428 98440 98480 98480 98480 98480 98480 98480 98480	INT EOU PR EQU ATUS EQU DEO EOU PREST EQU PREPLACE S THIS PHE BEGINNI ORG LD ORG LD ORG LD	8580H 37E8H 37E8H 9501H 9833H 580AH TART OP BUFFER IN SECTION REPLACES NG OF TEXT BUFFER NG OF TEXT BUFFER 8118H HL, DONE-OFFSET 838AH HL, DONE-OFFSET	; RON PRINTER DRIVER ; PRINTER ADDRESS ; RON PRINTER STATUS CK. ; RON VIDEO DISPLY ; REENTRY TO ASM2 N EDTASN WITH NEW BEG ** ALL EDTASM REFERENCES TO R NITH THE BEGINNING OF THE R.
37E8 45033 580A 8118 8118 8118 8118 8118 8787 18709 8709 8709 88707 88839 288839	18876 18876 18876 18876 18876	80399 PR 80310 VII 90329 VII 90338 WAS 80340 ;** 90380 ;** 90380 ; ** 90380 ; ** 90440	TR EQUINATUS EQUINEST	37E8H 85D1H 8833H 58DAH TART OP BUFFER IN SECTION REPLACES NG OF TEXT BUFFER ROOF TEXT BUFFER 8118H HL,DONE-OFFSET 83BAH HL,DONE-OFFSET	; PRINTER ADDRESS; RON PRINTER STATUS CK.; RON PRINTER STATUS CK.; ROM VIDEO DISPLY; REENTRY TO ASM2 N EDTASN WITH NEW BEG ** ALL EDTASM REFERENCES TO R WITH THE BEGINNING OF THE R.
8501 8033 580A 9118 218 838A 2838A 2838A 2707 18707 2708 2709 2708 28050 28050 28050 28060	18876 18876 18876 18876 18876	86310 ST/ 90320 VXI 90330 WAS 90340 ST/ 90350 ST/ 90350 ST/ 90380 ST/	ATUS EQUIDO EOU PREST EQUIPO EOU PREST EQUIPO EOU PRESTRICE S THE BEGINNI ORG LD ORG LD ORG LD ORG LD	#5D1H #833H 58DAH TART OF BUPPER IN SECTION REPLACES NG OF TEXT BUFFER ROOF TEXT BUFFER #118H HL,DONE-OFFSET #83BAH HL,DONE-OFFSET	;RON PRINTER STATUS CK. ;ROM VIDEO DISPLY ;REENTRY TO ASM2 N EDTASM WITH NEW BEG ** ALL EDTASM REFERENCES TO R WITH THE BEGINNING OF THE R.
8118 8118 838A 838A 838A 838A 8787 8787 8787 878	18876 18876 18876 18876 18876	90329 VIE 90338 WAS 90340 90338 9 1 2 9 9 9 1 3 9 9 9 1 3 9 9 9 9 9 9 9 9 9 9	DEO EOU RMST EQU REPLACE S THIS THE BEGINNI ORG LD ORG LD ORG LD ORG LD	0833H 58DAH TART OP BUPPER IN SECTION REPLACES NG OF TEXT BUFFEI NG OF TEXT BUFFEI 8118H HL,DONE-OFFSET 838AH HL,DONE-OFFSET	ROM VIDEO DISPLY REENTRY TO ASM2 N EDTASH WITH NEW BEG ** ALL EDTASH REFERENCES TO R WITH THE BEGINNING OF THE R.
8118 2: 8118 2: 838A 2 8410 1 8787 1 8707 1 8709 2 88707 2 88839 2 88839 2 88839 2 88839 2 88839 2	18876 18876 18876 18876 18876	00338 WAI 00340 00340 00360 00370 00380 00480 00410 00420 00420 00440 00440 00440 00440 00440 00440 00440 00440 00480	RMST EQU REPLACE S THIS THE BEGINNI ORG LD ORG LD ORG LD ORG LD	58DAH TART OF BUPPER IN SECTION REPLACES NG OF TEXT BUFFER NG OF TEXT BUFFER 8118H HL,DONE-OFFSET 83BAH HL,DONE-OFFSET	REENTRY TO ASM2 N EDTASH WITH NEW BEG ** ALL EDTASH REFERENCES TO R WITH THE BEGINNING OF THE R.
8118 2 838A 2 8418 1 8767 1 8708 2 88707 1 8708 2 8839 2 8839 2 8839 2 8839 2 8839 2 8839 2	18876 18876 18876 18876 18876	88358;**88360 98370; 983380; 883398; 884398; 88440 98428 98440 88459 88459 88468 88468 88468 88468	THIS THE BEGINNI NEW BEGINNI ORG LD ORG LD ORG LD ORG LD	SECTION REPLACES NG OF TEXT BUFFER NG OF TEXT BUFFER 8118H HL,DONE-OFFSET 838AH HL,DONE-OFFSET	ALL EDTASM REFERENCES TO R WITH THE BEGINNING OF THE R.
8118 2 838A 2 8418 1 8787 1 8707 1 8708 2 8839 2 8839 2 8839 2 8839 2 8839 2 8839 2	18876 18876 18876 18876 18876	80360 90370; 90380; 80390; 80400 60410 90420 90440 90440 90440 90440 90470 90460 90470 90460 90470	THIS THE BEGINNI NEW BEGINNI ORG LD ORG LD ORG LD ORG LD	SECTION REPLACES NG OF TEXT BUFFER NG OF TEXT BUFFER 8118H HL,DONE-OFFSET 838AH HL,DONE-OFFSET	ALL EDTASM REFERENCES TO R WITH THE BEGINNING OF THE R.
8118 2 838A 2 8418 1 8418 1 8707 1 8708 2 8858 2 8839 2 8839 2 8839 2 8839 2 8839 2	18876 18876 18876 18876 18876	98378; 98388; 98488; 88488 98419 98428 98428 98448 98448 98459 98488 98498 98518	THE BEGINNI NEW BEGINNI ORG LD ORG LD ORG LD ORG LD	NG OF TEXT BUFFER 8118H HL,DONE-OFFSET 838AH HL,DONE-OFFSET	R NITH THE BEGINNING OF THE R.
8118 2 838A 2 8418 1 8418 1 8707 1 8708 2 8858 2 8839 2 8839 2 8839 2 8839 2 8839 2	18876 18876 18876 18876 18876	00380 ; 3 00390 ; 3 00400 00410 00420 00440 00440 00450 00460 00460 00460 00460	THE BEGINNI NEW BEGINNI ORG LD ORG LD ORG LD ORG LD	NG OF TEXT BUFFER 8118H HL,DONE-OFFSET 838AH HL,DONE-OFFSET	R NITH THE BEGINNING OF THE R.
8118 2 838A 2 8418 1 8767 1 8708 2 88707 1 8708 2 8839 2 8839 2 8839 2 8839 2 8839 2 8839 2	18876 18876 18876 18876 18876	88398; 1 80480 80420 80420 80440 80440 80440 80470 80470 80470 80490 80490 80510	NEW BEGINNI ORG LD ORG LD ORG LLD ORG LLD	NG OF TEXT BUFFER 8118H HL,DONE-OFFSET 838AH HL,DONE-OFFSET	R.
8118 2 838A 2 8418 1 8418 1 8707 1 8708 2 8858 2 8839 2 8839 2 8839 2 8839 2 8839 2	18876 18876 18876 18876 18876	88418 88428 88438 88448 88458 88458 88478 88478 88498 88588 88518	LD ORG LD ORG LD	HL, DONE-OFFSET 838AH HL, DONE-OFFSET	r
8118 2 838A 2 8418 1 8418 1 8707 1 8708 2 8858 2 8839 2 8839 2 8839 2 8839 2 8839 2	18876 18876 18876 18876 18876	00 4 2 0 00 4 3 0 00 4 4 0 00 4 5 0 00 4 6 0 00 4 7 0 00 4 6 0 00 5 0 0 00 5 0 0 00 5 1 0	LD ORG LD ORG LD	HL, DONE-OFFSET 838AH HL, DONE-OFFSET	•
838A 2 8410 1 8410 1 8707 1 8700 2 8850 2 8850 2 8839 2 8839 2 8839 2 8839 2 8839 2	18876 18876 18876 18876 18876	00430 00440 00450 00460 00470 00460 00490 00500 00510	ORG LD ORG LD	83BAH HL,DONE-OFFSET	r
838A 2 8410 1 8410 1 8707 1 8700 2 8850 2 8850 2 8839 2 8839 2 8839 2 8839 2 8839 2	18876 18876 18876 18876 18876	90440 80459 80460 90470 90460 80490 80500 80510	ORG LD ORG LD	83BAH HL,DONE-OFFSET	
838A 2 8410 3 8410 1 8707 1 9709 2 8709 2 88850 2 88839 2 88839 2 88839 2 88839 2	18876 18876 18876 18676 18876	88459 88468 88478 88488 88498 88588	LD ORG LD	HL DONE-OFFSE	•
8410 8410 1 8707 1 8709 9708 2 8850 2 8839 2 8839 2 8839 2 8839 2 8839 2	18876 18876 18876 18676 18876	88468 88478 88468 88498 88588 88518	LD		г
3707 3707 3708 3708 3708 2 3850 2 8A39 8A39 8A39 2 8A39 2 8A39	18876 18876 18676 18876	00460 00490 00500 80510		841 BH	
9707 1 9709 2 9708 2 9850 2 8839 8 8839 2 9880 2 9880 2	18876 18876 18876	00490 00500 00510	ORG	DE, DONE-OFFSET	Г
9709 9708 2 9850 2 9839 8839 2 9860 6880 2	18876 18876 18876	00500 80510		8707H DE.DONE-OFFSE	T
9708 2 1050 3850 2 8A39 8A39 2 8A60 8A60 2	18676 18876	80510	LO ORG	87DBH	a
1858 1850 2 1839 1839 2 1839 2 1830 2	18676 18876		LD	HL,DONE-OFFSE	r
8A39 8A39 2 8A88 8A88 2 8F27	18876	00520	ORG	8850H	
8A39 2 BA60 BA80 2 BF27		00530	LD	HL DONE-OFFSE	r
BA60 BA80 2 BF27		00548	ORG	BA39H	-
8A88 2 8F27	10076	00550 00560	LD ORG	HL, DONE-OFFSE	ľ
8F 27		80570	I.D	8A88H HL,DONE-OFFSE	т
	/ •	00580	ORG	8F27H	
	18876	00590	LĐ	HL , DONE-OFFSE	т
		00608	*****		DD DOTUDO AAAAAAAAAAAA
		99619 ;*	*********	**** PRINTER P	RE-DRIVER
		00620 08630 ;	THE E	RE-DRIVER IS CAL	LED INSTEAD OF THE ROM
					OR A (CR), AND THEN OUTPUTS
					PRINTED IS NOT A (CR) THEN
		00660 ;		NTER DRIVER IS U	
		88678			
A13A		00680	ORG	ØA13AH	JOVERLAY TO RELOC. ASM2
		89690 99700 ;	mu	ADDITION TO TOTAL	OH TO ELLE DUGE
			DEUCDYN AL	ADDITION TO EDTA	SM IS TAIL ENDED TO THE
					S BEEN BLOCKED MOVED TO
		98738 ;	WILL BLOCK	NOVE IT DOWN TO	IST NORMAT ORIGION OF 5588H.
		88748		•	
			>>>>>>	OUTPUT ALL CH	AR EKCEPT (CR) ((((()
763A		88768	ADM SOO	f_onner-	
/03A Al3A 7	q	00770 ST		\$-OFFSET	COM CURD NO OF PRESSURE
Alam o		00790	LO EXX	A,C	GET CHAR TO BE PRINTED
A13C C		99898	CALL	VIDEO	
Alar D		99819	EXX	- 25.40	
A140 P		00828	CP	65 H	; IS IT A <cr></cr>
A142 C	28005	00630	JP	NZ, PRINT	JP TO ROM PRINTER DRIVER
		99848		Ottomation 10	
			>>>>>>>	OUTPUT <cr></cr>	<<<<<<
7645		88868 88878 OU	TPUT EQU	S-OFFSET	
A145 C	00145	98889	CALL	STATUS	CHECK THE PRINTER STATUS
A148 C		99899	JP	NZ,OUTPUT	IS IT READY?
A148 7	9	00900	LD	A,C	RESTORE (CR)
A14C 3	2E837	00910	LD	(PRTR),A	OUTPUT (00) TO PRINTER
		00920			
			>>>>> OUT	PUT <lf> AND C</lf>	HECK LINE COUNTER <<<<<
764F		88948	6011	£ 000000	
Al4F C	במוממ:	80950 LF 88968	EQU CALL	S-OFFSET STATUS	:IS PRINTER READY
A152 C		00970	JP	NZ,LP	, 10 FRIBIER READI
A155 3		98968	LĐ	A, ØAH	SET OUTPUT CHAR = <lf></lf>
A157 3	2E637	88998	LD	(PRTR),A	OUTPUT IT TO PRINTER
A15A 2	212948	01000	LD	HL, LINCHT	POINT TO LINE/PAGE CNTR.
A15D 3		91910	INC	(HL)	INC LINE/PAGE CNTR
A15E 7		81828	LĐ	A,(HL)	GET NEW VALUE OF CNTR
A157 F		01038 91040	CP . IB	54D	; RAVE 54 LINES PRINTED ?
A161 C	.201/0	01040 01050	· JP	N2,EXIT	
			·>>>>>	OUTPUT (FF)	<<<< <<
		91078		ODIEGI (IE)	**********
		01080 FF	EQU	\$-OPPSET	
7664		01090	CALL	STATUS	; CHECK PRINTER STATUS
A164 C		81100	JP	NZ, PF	
A164 C	26476	81110	ĽD	A, BCB	;SET OUTPUT CHAR = <fp></fp>
A164 C A167 C A16A 3	26476 BEBC		LD	(PRTR),A	PRINT IT
A164 C A167 C A16A 3 A16C 3	26476 Sebc 326837	81128	LĐ		NH 00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
A164 C A167 C A16A 3	26476 Bebc B2E837 B600		INC	(RL),06H HL	;RESET LINE/PAGE CNTR ;POINT TO PAGE CNTR

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Program continued				
A172 34 A173 CD8F75 A176 BE8D A178 CD3A76 A178 CD3A76 A17E CD3A76 7681 A181 79 A182 C9	81158 81168 81178 81198 81198 81298 81218 EXIT 81228 81238	INC CALL LD CALL CALL CALL EOU LD RET	(BL) PTPAGE C, BDH START START START START \$-OFFSET A, C	;INC PAGE # ;PRINT PAGE HEADEH ;SET OUTPUT CHAR = <cr> ;OUTPUT 3 <cr>'S TO ;SEPERATE NEADEH FROM ;TEXT ;RESTORE CHAR</cr></cr>
		THIS RO	UTINE USES A "<	ON EJECT ROUTINE ******* (SHIFT) `" TO REPLACE THE B MAND WILL GIVE A FORM PEED PAGE # COUNTERS
7683 A183 212A48 A186 3688 A188 2B A189 CD6476	01314 EJECT 01328 01338 01340 01359	EQU LD DEC CALL	\$-OFFSET BL,PAGCHT (BL),BBH HL FF	; POINT TO LINE/PAGE CNTR ; " <shift> @" SENT SO ; RESET PAGE COUNTER</shift>
A18C C3DA58	8136B 8137B	JP	NARMST	EXIT TO NARM RESTART
	81300 ;***** 91390	** FRIN	T PAGE BEADER RO	DUTINE ******
	81488 ; 81418 ; OF TH 81429		UTINE BILL PRINT	THE PAGE 4 INFO
768P A18P 218174 A192 CDAA76	81438 PTPAGE 81448 81458 81458	CALL.	S-OFFSET BL,NSG1 OUTSTR	PT TO BEG OF PAGE BEADER OUTPUT MESSAGE
		HEX TO	ASCII CONVERSIO	ON FOR PAGE # <<<<<<
	81498 ; 81509 ; CONVE 81518 ; NUST	RSION IN BE STONE TER CONT	ROM. THE 16 BIT TO AT 41218. AFT TAIBS THE ADDRESS	OF THE HEX TO ASCII T HEX VALUE TO BE CONVERTED EN THE CONVERSION THE "HL" S OF THE MOST SIGINIFICANT
A195 3A2A4B A198 6P	81559 81568	LD LD	A, (PAGCNT) L,A	GET BEX PAGE 4
A159 2688	9 1579	LD	H,00E	STORE PAGE COUNT INTO
A19B 222141 A19B 3BB2	01589 41598	ro ro	(4121B), HL A,2	; CELL TO BE CONVERTED ;LOAD # TYPE PLG FOR INT.
Alab 32AF49 Ala3 CDBD#F Ala6 CDAA76	01600 01610 01628 01638	CALL CALL	(48AFS),A 8FBDW OUTSTR	; TO HEX IMPUT ; CONVERT, RESULTS 'HL' ; HL PR TO STHING. OUTPUT ; PAGE 4.
Alag C9	B164B	HET		; PAGE 1.
	81658 81668 ;*****	** OU	ITSTR ******	*
		CTEN TO	"GL" REGISTER N	STRING FROM NEMORY TO THE UST POINT TO THE FIRST BH MUST BE THE LAST
76AA Alaa 4e	81738 OUTSTR 81748	FOU	\$-OFF5ET C,(BL)	GET CHAR TO BE PRINTED
A1AB 79	81750	LD	A,C	SET UP TO BE PRINTED
Alac Pess Alae Cs	91768 91778	CP RET	99a 2	; END OF STRING ? ; IF YES, RETURN
Alaf E5 Albø CDødø5	91789 91799	PUSB CALL	EL PRINT	JOUTPUT CHAR.
A1B3 E1 A1B4 23	91999 91919	POP INC	BL BL	PT TO NEXT CHAR
	01020	JP	OUTSTR	AUG TURK OF
A188 88	01838 81848 DOME 81858 81868		888	THIS IS THE END OF THE PRINTER PRE-DRIVER.
	01870 ;****** 01000 ;* 01090 ;*****	BLOCK	K MOVE AND INITI	ALIZATIOB *
	01900 01910 ; 01920 ; BEGII	THIS SI NS. THIS PRINTER I	ECTION IS WHERE SECTION WILL BL PRE-DHIVER DOWN	THE ACTUAL EXECUTION OCK NOVE THE EDTASH WITH TO ITS ACTUAL EXECUTABLE
A1B9 F3			BLOCATE EDTASM	**********
A1BA 210000	81998	DI LD	BL,9888E	BEG. OF HELOC. EDTASH
	92888 92818 82828 82838	TDIM TO TO	DE,55088 BC,DOME-ASHST	180VE EDTASN TO 18 OF BYTES TO BE BOVED 180VE IT !!
		>>>> GE:	T DATE & INSERT	IN READER MSG <<<<<<
A1C5 219BA2	82858 82868 82878	LO	HL, DATE	; POINT TO SPACE APTER ; "DATE:" IS MSG2
				Program continues

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	n con	linues					
Αl	CB	CD7844	02080	CALL	4470H		CONVERT DATE & STORE IN
			82898				, MSG2
			02100				
			02110	:>>>>> MOV	E HEADER F	ISG OVER A	PPARATE SIGN ON MSG <<<<<
			02120				
A1	CB	210074	02130	LĎ	HL,APE	PMSG	POINT TO APPARAT SIGN ON
A1	CS	3EAØ	92149	LD	A, BAB	4	; SET IST CHAR IN SIGN ON
A1	LDØ	77	02150	LD	(aL),	A	; MSG TO HST TERMINATOR
	IDI		82168	INC	HL		POINT TO HEXT CELL
Al	LD2	1100A2	02170	LD	DE, HSC	32	
	105		92199	EX	DE, BL		
A.l	LD6	015000	02190	LO	BC,890)	; SYTE COUNTER
Al	LD9	ed80	02200	LDIR			; MOVE MSG2 OVER APP, MSG
			02210				
				;>>>>> REF	LACE " 8 '	" WITH " <	SHIFT> @ " <<<<<<
			02230				
		212F58	92249	LD			TASH'S " 8 " COHMAND
		3E60	02250	LO	A,60H		; " <shift> 0 " ; " 8 "> " <shift> 0 "</shift></shift>
	LEØ		02260	LO	(HL),	A	
	121		82279	INC	HL		; PT LSB OF ROUTINE ADD
		110376	02200	LD	DE, EJI		;LS8 OF " <s8ift> @" ADD</s8ift>
	LE5		92298	LD	(HL),	£	CHANGE LSB OF CMD ADD
	186		02300	INC	HL		;PT TO MSB
A)	187	72	02310	LD	(HL),	٥	; CHANGE HSB
			02320				
				\$>>>>> FI	NK PRE-DR	IVER TO RO	M PRINTER DRIVER <
			92349			3	B
		213A76	02350	LD	HL,76		; "HL" = ADD OF PRE-DRIVES
A.	IER	222649	02360	LD		H),HL	; PATCH IN PRINTER DCB
			02300	10000000000	,,,,,,,,,,,	******	;\$
			02390	;\$ NOTE :	THIS SET	S SEATH H-	14 TO 96 CHAR / LINE
				\$ DELETE OF			
			82419	, , bondie o	. camada 1	0 111 1000	
A1	122	0816	92428	LD	C.16H		: OUTPUT CHAR = <esc></esc>
		CD4576	92438				OUTPUT IT
		Ø 275	02440		C,75H		; OUTPUT CHAR = <lc u=""></lc>
		CD4576	92450				, 001101 00121 120 07
		ØE1Ø	02460	LD			; OUTPUT CHAR = <ctl x=""></ctl>
		CD4576	92478	CALI			•
			82488			_	
			02490	, \$\$\$\$\$\$\$\$\$\$;\$\$\$\$\$\$\$\$\$\$	\$\$\$\$\$\$\$\$\$	\$
			02500	•			
	lFD	C3006E	02510	JP	6F00H		START EXECUTION OF ASM2
A.			02520				
Α.			02530	;>>>>>>>>	HEADER M	ESSAGE <<	<<<<<<
A.			02540				
A			43254	HSG2 DEFI	, ,	OATE: '	
A	200		02000		i '	1	;OATE INSERTED HERE
A:	200 20e		92552	DATE DEFI			nc I
A: A:		20				NEWDOS PI	109.
A: A: A:	20e	20 29	92552		3 I		Senoler¹
A: A: A: A:	20e 213	20 29 20	92552 92554	Defi Defi	1 1		
A: A: A: A: A:	20e 213 223 238 248	20 29 20 20	92552 92554 92569	Defi Defi Defi	i ! i !	Z-00 AS	semoler'
A: A: A: A: A: A: A:	20e 213 223 238 248 189	20 26 20 20 80	92552 92554 92569 92579	DEFI DEFI DEFI DEFI	i ! i !	Z-00 AS	semoler'

```
Program Listing 3
              00100 ;***
              09110
               00120
                                      OPTIONAL 'FORM FEED' ROUTINE
               00149
               00150
               00160
               99179
                    09100
               00190 ;$
                             NOTES:
               00200 $
                             1)
                                   THIS CAN REPLACE THE SECTION OF THE
                                                                                  $
                                FORM FEED ROUTINE TEAT OUTPUTS THE BCH.
                     : S
                             2) THE SEPERENCE COUNTER (IX+83) IS 67
LINES / PAGE. THIS CAN BE CHANGED BY
PORING THE VALUE DESIRED, OR BY ADDING:
LD 8L,48288
LD (8L),XX
               Ø9229
               88238
               00240
                     ; $
               00250
               09260
               00270
                              WHERE XX = THE # OF LINES/PAGE DESIRED
               00290
                     , $
                              INTO THE INITIALIZATION ROUTINE
               00290
                     : 5
               00300
                    00310
               00320
9988 ODES
               99338
                             PUSH
0002 CD9F05
                                      059FH
                                                        FINE # LINES LEFT OH
                              CALL
                                                        ; PAGE, AND OUTPUT
; <LP>'S.
; INC PAGE COUNTER
               00350
                                                               AND OUTPUT AS
               00360
0005 DD3405
               00370
                              INC
                                      (IX+05)
13do BB68
               00380
                              POP
                                                        ; INC PAGE COUNTER
                                      IX
               09390
gaas
               88488
                              END
                                              OELETE THIS LINE ***
80000 TOTAL ERRORS
```

dress of the first character to be printed, and that the last character be a 00H. OUTSTR gets the character pointed to by the HL register and compares it to 00H. If it is not a 00H, the ROM printer driver is called to output the character. When a 00H character is encountered, a return from the subroutine is executed without printing that character.

The page number is stored as a hexadecimal value at address 402AH, which is an unused cell in the printer DCB. The ROM hex to ASCII conversion routine is used to convert the page number to a printable value. It is assumed a program listing is less than 255 pages, so only one byte is needed for the counter. The HL register is loaded with the hex value to be converted which is then stored at 4121H. The hex to ASCII routine converts the value stored at 4121H and stores the results somewhere in memory. However, the HL register contains the address of the most significant digit converted. After the conversion, OUTSTR is again called to output the page number.

Another teature included with the page headers is incorporation of the date. When the DOS is booted, enter the date into the system by using the Date command. Then when EDTASM is loaded, it will convert the date to ASCII and store it in the header message. This is done in the initialization section.

Finally, we need some way to reset the page counter and possibly produce a top-of-form. To accomplish this, the B command (return to Basic) is replaced in the command lookup table by an @. Then the reset address of 0000H is changed to the start of the torm feed routine. Again, this is accomplished during initialization.

initialization

The initialization section has many functions. One important one is its ability to move EDTASM down to 5500H where Apparat Intended it to run. This is accomplished by lines 1960–2020. Next, the date is calculated and stored in the page header massage area of memory by lines 2060 and 2080.

Replacing Apparat's sign-on message is handled by lines 2110-2200. Apparat uses A0H as their end of string terminator. so the HL register is loaded with the starting address of their message. The accumulator is loaded with A0H and then stored at the address pointed to by the HL register. This pointer is then bumped, and the DE register is loaded with the starting address of the page header message. HL and DE are exchanged, to conform to the requirements of the LDIR instruction, and BC is loaded with the number of bytes to be moved. The LDIR instruction actually moves the message into the old sign-on area. Finally, the B command and its associated jump address are replaced with the @ sign and the formfeed routine's eddress. and the printer driver's address in the DCB is replaced.

Lebels

Many labels in the program have an offset of 2800H because EDTASM was moved

from 5500 to 8000H to enable us to work on it, save EDTASM and the patches. If it were left at 5500H, envireturn to DOS would have overlaid enother program. The program must be moved up to 8000H by using the LMOFF-SET program in NEWDOS. It will attach a short routine to the end, like the one in lines 1810-1850. followed by the jump in line 2210. The coding between lines 1850 end 2210 is not required for the printer pre-driver and will then be written over by EDTASM after it is executed.

Once the program has been written and saved to disk, you must merge the two programs. Use LMOFFSET to move ED-TASM to 8000H, and resave it to disk. Then return to DOS, Use Load to put program into memory (do not execute either program). Next load Tapedisk into memory, and save the programs from 8000H to A260H, with the entry point at Entry or A1B9H, I named the modified version of EDTASM ASM2 to avoid confusion as to which EDTASM is loaded.

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Star Colony



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The morning is bright and clear. A few clouds dot the sky at the higher altitudes. It is a perfect day for a launch.

To commemorate this great occasion, the Corps band has been borrowed from the World

Air Force. The band's music, harsh and tinny in your ears, blares across the allo-concrete. Your chiefs and aides stand stiffly erect, impatient with all this pomp and circumstance.

At last the music ends. There is the usual round of hand-shaking and well-wishing. When the farewells are done, you and your men board the shuttle. The craft launches and swiftly climbs to space where it mates with your enormous starship, the first to be

built in a long time since the Great War, Interstellar War I, the war against the D'nim (see Star Guard in an earlier issue).

It is only reasonable that humanity should make the long crawl back into space, you reflect during docking procedures. What is tragic is that It took so long for the Earth to recover from the ravages of IWI. Triumphant, yet with all her colonies lost, Earth has had a hard time pulling herself up to her former level. Your ship (you have the privilege of naming it) is a gigantic vessel, built solely for exploration and recolonization. You are to guide her in reopening the space lanes and reestablishing the footholds Earth once had.

Object of the Game

The object of this game is to colonize and explore as many star systems as the player can in the time alloted to him. (The time is randomly determined at the start of the game.) Upon departure, you have 100 per cent operation power and a full stock of supplies, along with 5000 prospective colonists in stasis. As power and supplies diminish, it will become necessary to replenish them. There are two methods of doing this. You can mine explored systems for radioactive fuel elements and raw materials for supplies, which takes away trom mission time (with the poorer systems yielding less and requiring more mining time than the richer systems). A decision may be made as to whether or not the player should resupply completely. Also, fuel and supplies will be used up during the years that mining and refining are taking place.

Another way to restock the ship is to revisit an established colony. If the colony is doing well, the members will gladly give you the supplies you need. A word of warning—if you take too much from the colony, you could tax the colony severely and cause it to fail. Obviously, the colonies to revisit are those which have high-yield concentrations of raw materials.

To establish a colony in a newly explored star system, the proper number of colonists (decided upon by the Captain) are brought out of stasis and sent down to the most hospitable planet available. They are given supplies, and then lett on their own. A return visit will show how the colony is faring. Any colony that has a population of 500 or more members is considered thriving and able fo aid in resupplying the ship. Some star systems are so poor

in materials that they should be bypassed and not even considered for colonization. Setting down colonists on these systems will be useless since they have almost no chance to survive and grow.

If you run out of time, the game ends. If you run out of fuel or supplies, your crew may toss you out the air lock, as there is no rescue available from Earth, if you last to the end of your mission, your performance will be evaluated and

2 CLEAR288

your superiors on Earth will decide how to reward you (or punish you!).

How To Play

There are four general commands available to you: Map, Scan, Jump, and Status. Difterent options are available within each command.

Map displays all the star systems within the range of your starship. Any attempt to explore outside the designated area will result in the starship

becoming lost or even destroyed in some cases. An option of this command is the History subcommand. If selected, all explored stars will be shown as an E and all colonized systems will be shown as a C. The starship is shown as an up arrow (†). This display allows you to see which stars you have visited and colonized.

A second option of the Map command is called the Rangefinder. With this option, you can pinpoint a particular

star on the map. By using the keyboard arrows, you move the rangefinder, "+", onto a selected star. Then the spatial co-ordinates (x, y, end z) may be displayed, as well as the star's distance from your starship.

Scan enables you to explore a star system, discovering such information as the number of planets in the system, the number of habitable (Terratype) planets, the grede of raw materials available and floral/ faunal evolutionary levels rang-

Program Listing, Star Colony

```
188 DATA 8,8,8,488,-1,-1,-4,541,-4,8,-8,468,-4,-1,16,532,-5,8,-1
3,465,-5,2,5,337,-6,2,1,334
182 DATA -6,-1,-19,526,-1,-6,14,861,8,-6,8,864,1,-6,18,867,2,-5,
17,896,4,-3,-18,684
184 DATA 5,-3,11,687,6-1,7,562,3,8,-21,489,7,1,8,437,9,2,15,379
6.31-2,386,-3,-18,151
184 DATA 5,-3,11,687,6,-1,7,562,3,8,-21,489,7,1,8,437,9,2,15,379,6,3,-2,386,-3,5,-18,151
186 DATA -7,4,11,283,-9,1,8,389,3,-7,-18,937,5,-6,7,879,6,-7,-8,946,7,-7,-12,749,9,-4,-1,763
188 DATA 7,-2,-7,629,7,5,-3,181,6,7,-2,58,-2,7,-2,26,8,5,8,184
118 DATA 50L, ALPHA CENTURI, INNES STAR, AC 79, CC 658, LALAMDE 21185, MOLF 359, LUYTEN 68-28, BD +68, BARNARD'S STAR, BD +59, S GAA DRACONIS, EPSILON INDI, KRUEGER 68, ROSS 248, BETA HYDRI, G ROOMBRIDGE 34, ETA CASSIOPEIAE, LUYTEM 726-8
112 DATA LUYTEN 97-12, BD +59, ROSS 128, DELTA PAVONIS, 61 CYGNI, CC -39, CC -49, LUYTEN 789-6, CD -36, TAU CETI, EPSILON ERIDAN 1, SIRIUS, RHO ERIDANI 1, SIRIUS, RHO ERIDANI 1918 DINST(32,5); DINST$(32,2); DIMPL(32,3)
115 SPS=
      1000 REM
      AND ARA
1818 CLS
1828 INPUT"LAST NAME"; NA$: IFNA$=""THENPRINT"NEED A NAME.": GOTO18
28ELSEIFLEN(NA$)>15THENPRINT"15 CHARACTERS OR LESS, PLEASE.": GOT
    01928
      1838 PRINT: INPUT YOUR SHIP'S NAME ", SHS: IFSHS = ""THENPRINT" NEED A
NAME FOR YOUR SHIP. ":GOTO1838ELSEIFLEN(SHS)>15THENPRINT" 15 CHARA
CTERS OR LESS, FLEASE. ":GOTO1838
    CIERS ON LESS, FLEASE, "GOTOIBSE 1848 FINT: RETAIN "; NAS; "[" 1848 FRINT: FRINT "BELCOME ABOARD THE "; SH$;", CAPTAIN "; NAS; "I" 1858 YE-RND(25)+35; PRINT: PRINT YOU HAVE"; YEARS; "YEARS BEFORE YOU MUST RETURN TO EARTH. ": PRINT: PRINT" GOOD LUCK!"

1878 RESTORE: FORA-1T032: FORE-1T04: READST(A, B): NEXTB: ST(A, 5) = 8: WE
      ATM 1875 FORA-11032:READSTS(A,1):ST$(A,2)-".":NEXT 1888 PW-188:(CL-5888:SU-188:CR-4:SC$-"Y":EN$-"Y":LA$="Y":SR-8:X-8:X-8:X-8:Z-8:AD-488:OV-2:IN-1:VI-8:ED-8:SD-8:LD-8:CC-2318:YR-8:H3$-"
[:H4$-":N5$-":H6$-":H7$="":C9$-CBR$(28)
      1885 PRINT"PRESS ANY KEY TO BEGIN."
1898 PRINKEYS-""GOTO1898
1100 CLS
      1100 CLS
1120 PRINT6968,CHRS(38);:INPUT"NAP, JUNP, SCAN, OR STATUS";R$:IF
R$="NAP" GOTO2888ELSEIFR$="JUNF" GOTO3888
ELSEIFR$="SCAN" GOTO4888ELSEIFR$="STATUS" GOTO5888ELSEGO
      2889 IFNA-1TNENNA-8:GOTO2188
2010 CLS:FORN-1T032:PRINT@ST(N,4), ".";:NEXTN:PRINT@AD, "[";:PRINT @968, "MANT STATUS OF VISITED STAR SYSTEMS? Y/N";:GOSUB9958:IFR=8
       GOTOLIEB TRINT8415, "SOL";:PRINT8768,"( - SHIP";:PRINT8832,"E - EXPLO RED ONLY"):PRINT8896,"C - COLONIZED";
2028 FORN=1T032:IFST$(N,2)="." NEXTELSEPRINT85T(N,4),ST$(N,2);:N
         2025 PRINTEAD,"
        2188 IPPEEK(14338 -64COTO2188ELSEPRINTE968, CHRS(38), PRINTE958, WANT RANGEFINDER? Y/N*,:COSUB9858:IFR-8GCTO8888ELSEPRINTE968, CER S(38), PRINTE968, "XEYBOARD ARROWS MOVE RANGEFINDER +. KEY I FOR INFORMATION."
        WITHIN (1498); ITH-OGUIVZEBELSET TOGUIVZEBELSET TOGUIVZEBELSET TOGUIVZEBELSECTOZIZE LSEITE TOGUIVZEBELSECTOZIZE LSEITE TOGUIVZEBELSET TOGUIVZ
        2228 PORELA+15368,LS:GOTO2118
2368 IPNA+64>959GOSUB9888:GOTO2128ELSENA=NA+64:GOTO2228
2488 IPNA+104GOSUB9888:GOTO2128ELSENA=NA-1:GOTO2228
2589 IPNA+10959GOSUB9888:GOTO2128ELSENA=NA+1:GOTO2228
2688 PORN+1TO32:IPST(N,4) = NAGOTO2658ELSENEXT
2618 GOSUB9918:PRINT8768, "NO STAR THIS LOCATION.";:M5$="":M6$=""
1MT5-":GOTO2128
2658 GOSUB9918:M5$-STS(N,1) + " SYSTEM":XX-ST(N,1):YY-ST(N,2):22
-ST(N,3):GOSUB2653:GOTO2678
2653 IPSGN(X)=SRGN(X)=TRENTYX-XXELSEDX=ARS(X)+ABS(XX)
        STIN,3]:GOBUB263:GOTO2678

2653 IFSGN(X)=SGN(XX)THENDX=XXELSEDX=ABS(X)+ABS(XX)

2654 IFSGN(Y)=SGN(YY)TNENDY=Y=YYELSEDY=ABS(Y)+ABS(YY)

2655 IFSGN(Z)=SGN(22)THENDZ=I=Z2ELSEDZ=ABS(Y)+ABS(ZY)

2660 DI=SOR(DX(2+DY[2+DZ[2]:RETURN
"+ STRS(ST(N,3)):M7S="DISTANCE-"+ STRS(DI] + "LY," 'PRINT076

8,MSS;IPRINT032,MSS;IPRINT0896,M7S;IPRINT09068,CHRS(30);PRINT09

68,"REY 'N' IF DONE ELSE MOVE RANGEFINDER.";:GOTO 2128

3888 IFPM<STERMPRINT*NOT ENOUGH POWER LEFT TO JUMP AGAIN, CAPTAI

N.";GOTO8080ELSEIPC9=CHRS(18)THENGOTO3018ELSECLS

3881 IPMSS:" PRINTMSS:PRINTM6S:PRINTN7S

3885 GOSUB3018:GOTO3025

3880 MITH*CURRENT LOCATION OF THE ";SHS;" - ";:FORN=1TO32:IPAD=
             3010 PRINT"CURRENT LOCATION OF THE ";SH$;" - ";:FORN=1T032:IFAD=
```

```
ST(N,4)ANDZ=ST(N,3)THENPRINTST$(N,1); SYSTEM*ELBENEXTN:PRINT*IN DEEP SPACE*
3028 PRINT* X*, " Y*," 2*:PRINTX,Y,Z:IPEN$="Y" TRENNX-7.5
    3821 RETURN
    3#25 PRINT'WANT TO JUMP? Y/N":GOSUB 9858:1FR=#GOTO3999
3#3# INPUT DESTINATION X CO-ORDINATE";XD:DD-XD:GOSUB95#8:IFR=#GO
   TO3838
3833 INPUT*DESTINATION Y CO-ORDINATE*;YD:DD-YD:GOSUB9588:IFR=8GO
    TO3033
3036 INPUT"DESTINATION Z CO-ORDINATE"; ZD; DD=ZD; GOSUB9500: IFR=0GO
  TOJB96
3838 XX=XD:TY=YD:ZZ=ZD:GOSUB2653
3848 IFD1<-NXGOTO3868ELSEPRINT*DISTANCE TO JUMP IS*;DI;*LIGHTYEA
RS.*:IFMX<7.5THENPRINT*GUR ENGINES ARE DAMAGED, CAPTAIN, AND WE
CAN ORLY JUMP*;MX:PRINT*LIGHTYEARS. ENTER EXACT CO-ORDINATES TO
JUMP,*:GOTO3825
3841 PRINT*THIS IS*;DI-MX;*LY GTR THAM THE MAXIMUM SAFE DISTANCE
*:PRINT*SHALL WE RISK CVERJUMP, CAPTAIN? Y/N*:COSUB9858:IFR=IGO
 ":PRINT IND AD JUL-MA; LI GTK THAM THE MAXINUM SAFE DISTANCE
":PRINT"SHALL WE RISK CVERJUNP, CAPTAIN? Y/N": GOSUB955%: IFR=1GO
T0385%
3842 PRINT"SHALL WE SET COURSE AND JUNP AS FAR AS WE CAN SAPELY?
Y/N": GOSUB965%: IFR=8GCT03825ELSEEX=8: DY-8: DZ=8: GOSUB93886
3843 IFX-XD-68THENDX=DX+IN: X-X+INELSEIFX-XD)9THENDX-DX-IN: X-X-IN
3844 GOSUB925%: IFR=1GCT03848
3845 IFY-YD-68THENDY=DY+IN: X-Y+INELSEIFY-YD-8THENDY-DY-IN: Y-Y-IN
3846 GOSUB925%: IFR=1GCT03848
3847 IFZ-ZD-68THENDZ=DZ+IN: Z-Z+INELSEIFZ-ZD-8THENDZ-DZ-IN: Z-Z-IN
3848 GOSUB925%: IFR=6GCT03843ELSEGCT03876
3850 GOSUB938%: OV-DI-T.5: IFOV>18THENRI-2ELSEIFOV>5THENRI-3ELSEIF
OV>ZTHENRI-4ELSEIFOV>8THENRI-5
3852 OV-RND(RI): IFOV>1THENPRINT: PRINT"WE HADE ITI": PRINT: X-XD; Y-
TD: Z-ZD: GOT03878ELSEFORN-1T028%: NEXTH: PRINT" CAPTAIN! WE HAVE OV
ENJUMPED!"
3853 Y-8PRO(23): Y-PND(18) 1 - T-SUM(41)
         ERJUMPED|"
3953 X=RND(22):Y=RND(18)-1:Z=RND(41)-21:IFX<24ANDY>11THENGOTO385
       3854 IFX<22ANDY<15THENGOTO3856ELSEPRINT:PRINT:PRINT"SCANNERS IND
    ICATE SPATIAL TIDAL FORCES INCREASING BEYOND OUR BULL'S ENDUR
AMCE. WE ARE BEING RIPPED APARTI":FORN=1T01598:NEXTN:GOSUB9288:
CLS:FORN-1T0368:NEXTN
3655 PRINT"SO MUCH FOR THE ";SHIFMAS:PRINT"AND HER CAPTAINI":PRI
NT:END

3856 PRINT:PRINT"WE'RE LOST, CAPTAIN!":PRINT:X=X=11:Y=Y=7:GOTO38

78

3868 IFX=XDANDY=YDANDZ=ZDTHENPRINT"NO JUMP WAS MADE - ZERO DISTA
NCE.":GOTO3825

3863 PRINT*DISTANCE IS";DI;"LY - A SAPE JUMP. SHALL WE JUMP? Y/N

"GOSUBSSS*!IFR=GOOTO3825ELSEX=XD:Y=YDI;Z=ZD:GOSUB9388

3878 IFABS(X)>160FABS(Y)>70FABS(2)>21THENPRINT:RRINT"CAPTAINI WE

"US STUMBLED INTO A BLACK HOLE!":PRINT"THE HOLE'S GRAVITY TIDES
ARE RIPPING US APARTI":FORN=1TO1588:NEXTN:GOSUB9225:CLS:FORN=1TO
388:NEXTN:GOTO3855

3875 IFOV)*ITHENPRINT*JUMP WAS SUCCESFUL. "ELSEOV=2
3868 AD-(-Y+7)*64+(X+18)" "3+2:VI=8:YR=YR+6:PW=PW-8:C9$=CHR$(18):
IFOV)*ITHENGSUB3818

3898 IFENS="N" GOTO3899ELSEIFRND(15)=1THENENS="N":EP=RND(98)/18+
1.2:MX=RND(4):PRINT*CAPTAIN: THAT LAST JUMP DAMAGED OUR ENGINES
. WE'LL ONLY BE ABLE TO JUMP;"MX;"LY! THE ENGINEES SAY IT'
LL TARE":EF; "YEARS":PRINT*TO FIX THE ENGIWES.":ED=CD+EF
3999 M55="":GOTO4898ELSEPM=PW-2
4888 IFPK:ZTHEMPRINT*NOT ENOUGE POWER FOR LONG RANGE SCANNERS, C
APTAIN.":GOTO4988ELSEPM=PW-2
4881 YR=YR+2:1PY-1=THEMPRINT*YGO'VE ALREADY SCANNED THIS SYSTEM
,CAPTAIN.":GOTO4986ELSEVI=1:CLS:PRINT*SCANNING....":FORN=17032:I
PAD=ST(N,4)ANDZ=ST(N,3)THENGOTO4188ELSENEXTH:PRINT*NO SYSTEMS WI
THIN SCANNING RANGE.":GOTO4988

4188 IF N:1 GOTO 4288 ELSE PRINT*THE SOL EYSTEM*:PRINT* X", Y",

""":PRINTSTAR(N,1), STAR(N,2), STAR(N,3):PRINT*PLANETS: 9":PRINT*
TERRA—TYPES: 1":PRINT*PLANETS: PSINT*HES SOL EYSTEM*:PRINT* X", Y",

""":PRINTSTAR(N,1), STAR(N,2), STAR(N,3):PRINT*PLANETS: 9":PRINT*
TERRA—TYPES: 1":PRINT*PHENTY=9:PSI*R*
4288 IFRINT*TEE STS(N,1);" SYSTEM*:PRINT* X", Y", Z":PRINTST(N,1);
1):P2-SPINT*MED STS(N,2);
208 IFRINT*TEE STS(N,2);
219 ST(N,5):PSINT*BENDT*9:PSINT*S:PSINT*ASS:STS(N,2)="E":PRINT*
4221 ITY=60XTY=9THENDT*9:PSI*PSI*PSI*PINT*
4221 ITY=60XTY=9THENDT*99:PSI*PSI*PINT* X", Y", Z":PRINT*
4221 ITY=GOTY=20ETSEST(N,5)=TY+18:PRINT*PINT* PRINT* WE'D BETTE
R GET OUTTA BERE!"."I=PRINT*POWER DRAINED TO ",PW:PRINT*WE'D BETTE
R GET OUTTA BERE!"."I=PRINT*POWER DRAINED TO ",PW:PRINT*WE'D BETTE
R GET OUTTA BERE!"."I=PRINT*PO
       3856 PRINT:PRINT"WE'RE LOST, CAPTAIN: PRINT: x-x-11:Y=Y-7:GOTO38
```

Program continues

```
GINEERS BAVE FIXED TRE JUMP ENGINES, SIRI FULL JUMP Y HAS BEEN RESTORED! ":EN$="Y"
 ETURN
9809 REM SPACES TO CORNER
9810 REM SPACES TO CORNER
9810 REM OP MSGS
9819 REM OP MSGS
9828 PRINT"FULLY OPERATIONAL": RETURN
9838 PRINT"FULLY OPERATIONAL": RETURN
9838 PRINT"REDUCED CAPACITY": RETURN
9849 REN GET RESPONSE Y ON N
9858 IP PEEK(14344) = 2 THEN R-1 ELSE IP PEEK(14338) = 64 THEN R-8 E
 LSE GOTO 9858
9855 IF PEER(14344) >< 2 AND PEER(14338) >< 64 THEN RETURN ELSE GOTO 9855
GOTO 9855
9199 REM JIGGLE SCREEN
9288 FOR N=1 TO 15;GOT255,8:FOR D=1 TO 3:NEXT D:GUT255,8:FOR D=1
TO 3:NEXT D:NEXT N:RETURN
9224 REM FELL INTO A BLACK HOLE
9225 CLS:FOR N=1 TO 18:PRINTERND[959],".";:NEXT N:PRINTE488,"";
 :M-408:FOR N=1 TO 20:FRINT00,CHR5(23);:FOR D=1 TO 3:NEXT D:FRI
00,CHR5(28);:FOR D=1 TO 3:NEXT D:IF N>0 THEN M=M-40:FOR F=1 TO
INEXT P
9226 NEXT N:RETURN
9249 REM FINU DIST
9259 IF SQR(DX[2 + DY[2 + DZ[2] > MX THEN R=1 ELSE R=6
9251 RETURN
 9269 REM FIND SYSTEM NAME
 927F FOR N=1 TO 32:IF ADDR=STAR(N,4) AND Z=STAR(N,3) THEN PRINT"
- THE ";STARS(N,1);" SYSTEN." ELSE NEXT N:PRINT
 - THE ";ST.
9271 RETURN
 9299 REN JUMP SCREEN
9388 CLS: FOR N-1 TO 10:X1=RND(62):Y1=RND(13):PRINT@Y1*64+X1,"."
;:MEXT:FOR N-1 TO 200:WEXT:FOR N-1 TO 5:FRINT@0,CHR$(23):FOR D=
1 TO 3:NEXT:FRINT@6,CHR$(28):FOR D=1 TO 3:MEXT:PRINT RCLS
9391 VA=176:GOSUB 9385:VA=32:GOSUB 9385:CLS:FOR N=1 TO 200:NEXT
 MIRETURN
9385 Kl=15838;x2=15848;x3=X1;x4=X2;POR N=1 TO 6;x3=X3+68;XI=X1-6
8;X4=X4468;X2=x2-68;PORE X1,VA;PORE X2,VA;PORE X3,VA;PORE X4,VA;
NEXT N;RETORN
NEXT N:RETORN
9399 REM SYSTEM VALUE
9400 TYPE-STAR(SHIPLG(N,2),5)
9405 IF TYPE-98 THEN M35="LOW GRADE METALS";M45="NO FAUNAL/FLORA
L TYPES":RETURN ELSE IF TYPE-99 THEN M35="NO VALUE WHATEVER";M45
=""; RETURN ELSE IF TYPE>10 THEN TYPE-TYPE-10
9410 IF TYPE-1 OR TYPE-2 OR TYPE-3 THEN M15="LOW" ELSE IF TYPE-4
OR TYPE-5 OR TYPE-6 THEN M15="M16" ELSE IF TYPE-6 OR
TYPE-5 THEN M15="M16H"
TIPE="3 THEN MIS="HIGH"
9428 IF TYPE=1 OR TYPE=4 OR TYPE=7 THEN M25="LOW" ELSE IF TYPE=5 OR TYPE=8 THEN M25="MED" ELSE IF TYPE=3 OR TYPE=6 OR TYPE=9 THEN M25="HIGH"
9438 M35=H15 + " GRADE METALS": M45=M25 + " LEVEL FAUNAL/FLORAL TYPES"
 reso
9458 RETURN
9588 IPDD><int(DD) PRINT: PRINT"HUST BE INTEGER": PRINT: R=@ELSER=1
 9501 RETURN
```

ing from primitive to highly evolved. You may colonize any system that has been explored except hostile, inhebited systems. The only option in such a case is to leave quickly or to eventually be shot down.

Program continued

If you choose to colonize a particular system, take note of the system's resources. If the system is poor, initially more supplies will be needed to start the colony. If you choose to force the colonists to land against their will, you may find them unreceptive to a return visit.

After the decision of colonization has been settled, you have the option of mining and refining the system's resources for future supplies.

The command Jump allows your ship to travel instantaneously from one point in space to another without crossing the intervening distance. This is the same method of travel that was used in "Star Guard." (Seven and a half lightyears is the maximum safe

Program continues

distance for jumping.) Jumping beyond this there is the danger of becoming lost by jumping to a random point in space along with blowing your ship's engines. In these situations, you will have to limp along as best you can until your engineers can repair the damage.

ABILIT

Status indicates in percentiles your reserve of supplies and fuel remaining, colonists left in stasis, and years lett in the mission.

The Mission Begins

You feel a low rumble through the soles of your feet. Your shuttle has docked. As you wait for the air to cycle into the docking bay, you almost feel the weight of the entire world settling onto your shoulders. So much depends on your success! Grimly, you vow not to waste supplies or colonists. You ere determined to explore and colonize as many of the best star systems as you can. The mission has begun.

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Interest-generating programs for the Pocket Computer.

Loan Sharp

Walter J. Atkins, Jr. Ph.D. Otrs 4410A USAF Academy, CO 80840

lave you ever wondered what the monthly payment on a new car would be, or doubted that a salesman was quoting you the true interest rate? The Pocket Computer can help you.

I selected three programs ideally suited for the TRS-80 Pocket Computer from my collection of tinancial programs for my Model I. The first program finds the term of a loan. The second finds the loan payment amount. The third finds the true annual interest rate. I have combined these into one Pocket Computer program.

Each of the program modules can also be used alone.

The Pocket Computer has a defined program mode that allows any of several programs in memory to be run by pressing two keys. If the computer is put into the defined program (DEF) mode, pressing Shift A runs the module that finds the term of a loan. Pressing Shift B runs the payment amount module, and Shift C runs the interest rate module.

The Program

The program takes about 800 steps and uses half the Pocket Computer's memory. The program is 40 lines long; it should be obvious to those of you who do not yet have a Pocket Computer that it can easily handle some very serious computing

The loan program is divided into three parts. Lines 10-70 find the time required to pay off a loan of a certain amount when the interest rate and amount of monthly payments are known. There is a minimum

10 :REH *LOANTERM-SHETA

26 (PAUSE"FINE LOAN TERM"

payment that must be made to pay off a loan. It a monthly payment of less than that minimum is made, the interest will exceed the payment and the loan will never be paid off. It a monthly payment less than the

```
25 (INPUT"LOAN AMOUNT= 1" F
36 (INFUT"ANN.INT.FATE()= 1" 1
35 :2*F*I 1200:2*INT\2*100* 5:100
40 :FAUSE"TO FAY LOAN AT " I:FAUSE"FEFCENT"
35 ::=F*I 1200:2*INTC*INC* 5*:100
40 :FAUSE"TO FAY LOAN AT " 1:FAUSE"FEFCENT"
45 :FAUSE"MINIMUM FAYMENT=1" 0
50 :INFU"MONTHLY FAYMENT= "" 0
60 :N*Y*12:N*INT(N*-5*)
60 :N*Y*12:N*INT(N*-5*)
     :FRINT"LOAN TERM: MONTHS := " H
65 (FF1)
70 (END
100: PEM *LOAMPAGMENT*
110:"6"
 115: FAUSE"FIND PRYMENT AMOUNT"
120: IMPUT AMOUNT OF LORNS TO P
130: IMPUT AMN.INT.RATE (1.5 - 17:1:1=1 100
140: IMPUT NUMBER OF MONTHS=21" N
150: 0=(1*P>127: (1=+) 1212+1/2-N //
 160:0=1NT:0+100+.5: 100
 170:PRINT"MONTHLY PAYMENT ##" 0
 180:END
 200:FEM *FINDFATE*
 215 PAUSE"FIND INTEREST PATE"
 220: IMPUT "MONTHLY PRIMENT = 7" 0
230: IMPUT "AMOUNT OF LOAN= 7" P
240: IMPUT "NUMBER OF MONTHS = " N
 250: I=10: J=0
 250:1=10:3=0
260:1=12100:PAUSE"COMPUTING..PLS..WAIT"
270:R=(14P 12:7<1-1<12:12+17^-NJJ:R=INT(F*100* 5 < 100
280:k=ABS(I*100-7/ 2:J=1*100
 290:1F R=0 THEN 330
300:1F R>0 THEN 320
 310:1=1+100+K:G070 260
 320;1=1*100-k:GOTO 260
330;1=1*100:1=1NT:1*1000+.5/ 1000
  340:PR1NT"ANN.INT.RATE: "./=" 1
 350 : ENE
                                       Program Listing.
```

I-Annual interest rate in percent

J-Last interest rate guess

K-Interest rate increment

N-Loan term in months

P-Amount of loen O-Monthly payment

R-Computed payment in interest rate module

2-Minimum monthly payment

Table 1. Variables

minimum is entered in the program, the Pocket Computer indicates an error when it tries to evaluate the LOG function in line S5. I have included lines 3S-4S at the computer calcufates and displays the minimum payment before it asks you to enter your monthly payment.

Lines 100-180 calculete the monthly payment required to pay off a loan of a certain amount in a specified period at a given interest rate.

Lines 200-350 calculete the annual interest rate. This section uses an iterative technique to determine the rate. First it assumes an interest rate of 10 percent. It then calculates the payment necessary to pay off the loan at thet interest rate, if the celculated payment is higher then the monthly payment you entered, it assumes a lower interest rete and repeats the process. If the calculated payment is lower than your monthly peyment, it essumes a higher interest rete

end repeats the process. After a few iterations, the computer zeroes in on the true interest rate. The iteration process can take several seconds, so in line 260 I have the computer print out the message "COMPUTING..PLS..WAIT" after each iteration.

SHFT A
Find Loan Term
Loan Amount #>? 10000
ANN, INT. Rate(%) =>? 15
To Pay Loan At 15 Percent
Minimum Payment = \$125
Monthly Payment =>?1234,56
Loan Term (Months) #9

SHFT 6 Find Payment Amount Amount Of Loan =>? 1234.56 ANN. INT. Rate(%) =>? 10 Number Of Months =>? 24 Monthly Payment = \$56.97

SHFT C Find Interest Rate Monthly Payment = >? 900 Amount Of Loan = >? 85000 Number Of Months = >? 360 ANN, INT. Rate(%) = 12.391

Table 2. Sample Runs

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Tired of abbreviations for error messages? Read on.

Full Error

Harry and Ken Keairns 920 La Plante Sioux City IA 51109

While friends with expansion interfaces and disk drives enjoyed full error messages, we struggled with the two letter abbreviations characteristic of Level II Basic. After almost wearing out the Basic Reference Manual, we set out to find a way to develop longer messages on our system, without spending the money for a disk system.

Our first effort produced the Basic program in Program Listing 1. We generally loaded this before we started developing a program, and after the program was debugged, replaced it with an error handling routine. While it served our initial purpose, it

was inconvenient to load it for every program.

It gave us a better understanding of the ERL and ERR/2+1 functions, which are important when developing an error routine. The ERL function returns the line number that contains an error, and the ERR/2+1 function returns the error number that corresponds with the table on page B/1 of the manual.

RAM Link

Like many TRS-80 users, we spend time wandering around the ROM area. On one of these excursions we discovered that memory location 41A6H provides a link between the Level II error routine and the RAM area of memory. This location is called both before the error message is sent to the screen and immediately afterward.

Program Listing 2 disassembles this area of ROM (19FEH thru 1A1EH), with remarks on the portion we will be changing. The link location (41A6H) normally contains a Return statement, but provision was made

for a three-byte Jump command to another location in memory. We will use this provision to replace the ROM routine with one of our own design.

Replace the first 16 bytes of the ROM routine, and use the balance of the routine to send the remainder of the message (i.e., "Error in line nn").

The first section of Program Listing 3 is a short routine that replaces the Return statement at 41A6H with a jump to the start of our routine. After loading the object code tape, entering a start point of 32292 initializes the new subroutine. This will have to be repeated in the event of a system crash, but can be protected by answering the memory size question with 32291 when you first bring the '80 to life.

The second section defines the messages to be sent to the screen in place of the two-letter abbreviations. Note that the messages end with a CHR\$(34), as the ROM routine used to get the message to the screen looks for this as a delimiter. When it finds a quotation mark (or a zero

byte), it knows the message is complete.

The next section is a table of the addresses for the messages previously defined. This approach is similar to the approach used by the ROM routine, and it solves the problem of messages of unequal length.

The final section selects the message, sends it to the screen, and then completes the message using the original ROM routine.

The actual selection is handied by loading the HL registers with the first address in our twobyte address table. The ERR code is then added, and the HL registers are pointed at the proper message. Make use of the DE registers to retrieve the address-save their contents with a PUSH instruction. After loading the address bytes, exchange DE and HL, as the routine expects to find the address there. Restore DE with a POP and the message is ready to be sent to the screen.

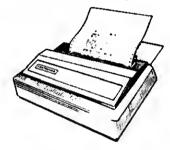
Now make a CALL to 26A7H, the location of a ROM routine that displays a string on the MODEL II



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A capy of the manufacturer's worronty can be obtained free upon specific written request to the Electronic's Department of our Caira, Georgia Retail Store. screen. After sending the string revert to the ROM routine to send the word "error," and the line number, if appropriate, End

the routine with a Jump to 1A1FH, the location immediately after the second call to 41A6H.

This program uses less than 500 bytes and usually saves much more than the eight-second loading time in look-up time atone. We also hope it will provide the ROM-roamers amongst us with new locations to experiment with.

```
ON ERROR GOTO 24 : GOTO 25

1 PRINT664, "NEXT WITHOUT FOR ERROR IN LINE"; ERL: END
2 PRINT664, "SYNTAX ERROR IN LINE"; ERL: END
3 PRINT664, "RETURN WITHOUT GOSUB ERROR IN LINE"; ERL: END
4 PRINT664, "OUT OP DATA ERROR IN LINE"; ERL: END
5 PRINT664, "OUT OP DATA ERROR IN LINE"; ERL: END
6 PRINT664, "OUT OF MEMORY ERROR IN LINE"; ERL: END
7 PRINT664, "OUT OF MEMORY ERROR IN LINE"; ERL: END
8 PRINT664, "OUT OF MEMORY ERROR IN LINE"; ERL: END
9 PRINT664, "OUT OF MEMORY ERROR IN LINE"; ERL: END
10 PRINT664, "REDIMENSIONED ARRAY ERROR IN LINE"; ERL: END
11 PRINT664, "REDIMENSIONED ARRAY ERROR IN LINE"; ERL: END
12 REM
13 PRINT664, "REDIMENSIONED ARRAY ERROR IN LINE"; ERL: END
14 PRINT664, "OUT OF STRING FOR ERROR IN LINE"; ERL: END
15 PRINT664, "OUT OF STRING FOR ERROR IN LINE"; ERL: END
16 PRINT664, "STRING TOOL LONG ERROR IN LINE"; ERL: END
16 PRINT664, "CAN'T CONTINUE ERROR IN LINE"; ERL: END
17 PRINT664, "CAN'T CONTINUE ERROR IN LINE"; ERL: END
18 PRINT664, "ON RESUME ERROR IN LINE"; ERL: END
19 PRINT664, "RESUME WITHOUT ERROR IN LINE"; ERL: END
21 PRINT664, "NO RESUME ERROR IN LINE"; ERL: END
22 PRINT664, "BAD FILE DATA ERROR IN LINE"; ERL: END
23 PRINT664, "BAD FILE DATA ERROR ": END
24 ON ERR/2+I GOTO 1.2,3,4,5,6,7,8,9,18,11,12,13,14,15,16,17,
18,19,28,21,22,23
25 REM

**START YOUR PROGRAM HERE

**START YOUR PROGRAM HERE

**START YOUR PROGRAM HERE

**PROGRAM LISTING 1.**
```

```
19EC CDA641
19EF 57
                                                                                     19ECH
                                                                  CALL
LD
LD
CALL
ADD
LD
                                                                                                                           TAAM LINK LOEATION
PUT ERROR CODE IN D
TQUESTION HARK
DISPLAYS SINGLE BYTE
FOINTS TO TYPE OF ER
IGET FIRST LETTER
IDISPLAY LETTER
IDISPLAY LETTER
                                 00110
                                                                                     4186H
                                 00120
                                                                                     D.A
A.JEH
19F0 3E3F
19F2 CD2A03
19F3 19
19F6 E
19F7 CD2A03
                                 00130
00140
00150
                                                                                     032AH
HL-OE
A.(HL)
                                 00170
                                                                   CALL
RST
                                                                                                                           FINC HE AND LOADS 2ND LETTER
IDISPLAY 2ND LETTER
POINTS TO WORD 'EAROR'
 1974 07
1978 CD2003
                                 00150
                                                                   CALL
                                                                                     032AH
1978 CD2003
197E 211D19
1A01 ES
1A02 2AEA40
1A05 E3
1A06 CDA728
1A09 E1
                                 00200
                                                                                      HL.1910H
                                                                                       HL, (40EAH)
                                                                                     ($P), HL
28A7H
                                 00230
                                 00240
 140A 11FEFF
                                                                                      DE DEFFEH
                                 00260
 140D D
                                 00270
                                                                   RSI
1A0D DF
1A0E CA7406
1A11 7C
1A12 A5
1A13 3C
1A14 C4A70F
1A17 3EC1
1A19 CD8E03
1A1C CBAC41
0000
                                 00276
00280
00290
00300
00310
00320
00330
                                                                  RSI
JP
LD
AMD
INC
CALL
LD
                                                                                      Z:0674H
                                                                                     NZ . OF A7H
                                                                                      A. OCTH
                                                                                      OBBRH
                                00340
                                                                                      41ACH
 00000 TOTAL ERRORS
                                                                   Program Listing 2.
```

```
កខទ
                    7F24H
00100
00110 : ******************************
                                                                    00670
                                                                                 DEFW
                                                                                         OMERR
00120 :4
                                                                    00680
          THIS SECTION INITIALIZES RAM LINK
00130 :
                                                                    00690
                                                                                 DEFM
                                                                                         BSERR
                                                                    00700
                                                                                         DDERR
                                                                                 DEFW
00150 :###****************************
                                                                    00710
                                                                                         DOERF
00160 :
                                                                    00720
                                                                                 DEFM
                                                                                         TDERR
00170
                                   ;PCINT TO RAM LINK
                    HL,41A6H
                                                                    00730
                                                                                 DEFU
                                                                                         THERR
                                    FIND START
00180
            LD
                    DE-START
                                                                    00740
                                                                                         OSERR
                                   :.IUMP 10 -
00190
             0.1
                    (HL) FOC3H
                                                                    00750
                                                                                 DEFU
                                                                                         LSERR
00200
             INC
                    HL
                                                                    00740
                                                                                 DEFM
                                                                                         STERR
00210
             LD
                    (HL);E
                                   :- LSB
                                                                    00770
                                                                                 DEFW
                                                                                         CNERR
00220
             INC
                                                                    00790
                                                                                  DEFW
                                                                                         HRERR
                    H
00230
             LD
                    (HL) ,D
                                   - - MSB
                                                                    00790
                                                                                 DEFM
                                                                                         RUFRR
00240
                                   :BACK TO BASIC
                                                                    00800
                                                                                 DEFU
                                                                                         UEERR
00250 : **********************************
                                                                    00810
                                                                                         HOERR
00260 :*
                                                                    00820
                                                                                 DEFM
                                                                                         FOFER
00270 :#
          THIS SECTION DEFINES THE ERROR MESSAGES
                                                                    00830
                                                                                 DEFM
                                                                                         L3ERR
00280 :#
                                                                    00840 :
00290 :**********************************
                                                                    00850 ;**********************************
00300
                                                                    *: 00860
                    'NEXT WITHOUT FOR"'
00310 NFERR
             DEFM
                                                                    00870 :#
                                                                               THIS SECTION SELECTS THE CORRECT MESSAGE
00320 SNERR
             DEFR
                     'SYNTAX"
                                                                    *: 08800
00330 RGERR
                     RETURN WITHOUT GOSUB"'
                                                                    DEFM
00340 ODERR
00350 FCERR
                    'OUT OF DATA"
             DEFM
                                                                    00900 :
                    'ILLEGAL FUNCTION CALL"'
'OVERFLOW"'
             DEFM
                                                                    00910 START
                                                                                 LD
                                                                                         HL , TABL
                                                                                                        POINT TO LOOK-UP TABLE
00360 OVERR
             DEFH
                                                                    00920
                                                                                 ADD
                                                                                         HL . BC
                                                                                                        :ADVANCE TO MESSAGE NEEDED
00370 OHERR
             DEFM
                     DUT OF MEMORY"
                                                                    00930
                                                                                 PUSH
                                                                                                        SAVE REGISTER
                                                                                         DΕ
003B0 ULERR
             DEFM
                     'UNDEFINED LINE"
                                                                    00940
                                                                                 LD
                                                                                         E, (HL)
                                                                                                        GET LSB OF MESSAGE ADDRESS
                     SUBSCRIPT OUT OF RANGE"'
00390 BSERR
             DEFM
                                                                    00950
                                                                                 1NC
                                                                                         HI
                                                                                         D, (HL)
00400 DDERR
                     REDEMENSIONED ARRAY"
             DEFM
                                                                    00960
                                                                                 LD
                                                                                                        GET MSB OF MESSAGE ADDRESS
00410 DOERR
                                                                                         DE, HL
             DEFH
                     'DIVIDE BY ZERO"
                                                                    00970
                                                                                                        :POINT TO MESSAGE
                    'ILLEGAL DIRECT COMMAND"
'TYPE MISMATCH"'
00420 1DERR
             DEFM
                                                                                                        RESTORE REGISTER
                                                                    00980
                                                                                 POP
                                                                                         DΕ
00430 THERR
             DEFM
                                                                    00990
00440 OSERR
             DEFM
                     'OUT OF STRING MEMORY"'
'STRING TOO LONG"'
                                                                    00450 LSERR
             DEFN
                                                                    01010 ±#
00460 STERR
             DEFM
                    'STRING TOO COMPLEX"'
                                                                    01020 :#
                                                                               THIS SECTION SENDS MESSAGE TO THE SCREEN
                     CAN NOT CONTINUE"
00470 CHERR
             DEFM
                                                                    01030 ;#
00480 HRERR
                     NO RESUME"
             DEFH
                                                                    01040 **********
                                                                                        ****************************
00490 RWERR
                     'RESUME WITHOUT"'
                                                                    01050 OUTPT
             DEFH
                                                                                 CALL
                                                                                         28A7H
                                                                                                        :DISPLAY STRING TO SCREEN
00500 LIEERR
             DEFH
                     'UNPRINTABLE"
                                                                    01060
                                                                                                        POINT TO 'ERROR' MESSAGE
                                                                                         HL,191DH
00510 MOERA
             DEFM
                     MISSING OPERAND"
                                                                    01070
                                                                                  PUSH
                                                                                         Ht.
                                                                                                        :SAVE IT
00520 FDERR
                     BAD FILE DATA"
                                                                                         HL, (40EAH)
                                                                    01080
                                                                                 LD
00530 L3ERR
             DEFM
                    'DISC BASIC ONLY"
                                                                    01090
                                                                                         (SP),HL
00540 :
                                                                    01100
                                                                                  CALL
                                                                                         28A7H
01110
                                                                                  POP
00560 ;#
                                                                                         DE-OFFFEH
                                                                    01120
                                                                                  LΦ
00570 :* THIS SECTION IS A TABLE OF MESSAGE ADDRESSES
                                                                    01130
                                                                                  RST
                                                                    01140
                                                                                  JP
                                                                                         7.0674H
01150
                                                                                  i,D
                                                                                         A.H
00800
                                                                    01160
                                                                                  AND
00610 TABL
                                                                    01170
                                                                                 1NC
00620
             DEFU
                    SNERR
                                                                    01190
                                                                                         NZ, OF A7H
                                                                                 CALL
00630
             DEFU
                    RGERR
                                                                    01190
                                                                                 LD
                                                                                         A-OCIH
00640
             DEFW
                    ODERR
                                                                    01200
                                                                                 CALL
                                                                                         038BH
00650
                     FCERR
                                                                    01210
                                                                                         1A1FH
00660
             DEFM
                    OVERR
                                                       Program Listing 3.
```

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Store source and object code on disk with this Microsoft program.

Modifying EDTASM Plus

Arne Rohde Pllevej 31 7600 Struer Denmark

ne of the main problems with converting from a tape-based TRS-80 to disk drives is that many programs use tape for data storage. Conversion is usually no problem with Basic programs, since the user has accass to the source code and relocation is handled by the Basic interpreter. System programs are often more problematic. Relocation is complicated. if the source code is not available, and is desirable, if DOS facilities are needed and the program storage area conflicts with the DOS storage area.

The common solution is to move the program in memory so it can be loaded with DOS, then move it to its correct location, destroying the DOS. The DOS facilities, such as data storage on disk, are no longer available, and the user is forced to contin-

ue to use tape for this purpose.

Microsoft Editor/Assembler Plus

Microsoft's Editor/Assembler Plus is tape-based. It was intended to replace Radio Shack's EDTASM and T-Bug, offering more facilities at a lower price. The disadvantage is that no modification is available allowing it to be used on a disk-based system to store source and object code on disk.

Apparat Inc. has made a modification to Radio Shack's EDTASM which allows it to be used with TRSDOS or NEWDOS. It comes with NEWDOS/80, but the user must purchase the Radio Shack version to obtain the documentation. There are still advantages to using the Microsoft version, such as a macro facility, the ability to generate code directly into memory, and the option of leaving the source in memory while the program is debugged with Z-Bug.

I have used both and prefer the Microsoft version for most purposes, even though it lacke a cross-reference listing facility. The program itself uses almost 12K storage when all modules are resident, so the sheer size of the tesk puts relocation out of the question for me. However, relocation is the only way to store source code on disk. If the Dump command could be used to move the source to disk and Load used to reloed it into memory before the assembler is moved into position, the source code need not be stored on tape. Since object code can be generated directly into memory (as long es it does not conflict with the assembler), Dump can also be used to store the object code on disk. In certain cases it may be necessary to write the object code to tape, and then copy it to disk with TAPEDISK or similar utllity.

Modifying EDTASM/Plus

I have not been able to find any free memory within ED-TASM/Plus, so the modifications must be made by removing commands and using up the resulting space by appending the utility onto the end of the code and forcing the program to regard this es reserved memory or by tocating the utility at the high end of memory and forcing the program to avoid this area.

I rejected the first approach, since none of the commands seem dispensable. The third approach requires different procedures for different memory sizes and restricts the routines which can be located in this area. I chose the second approach, even though it has one major disadvantage-quashing the assembler or Z-Bug destroys the modification. However, if quashing is necessary, the advantages of having ell three routines available simultaneously would no longer apply. Since I have 48K available (over 32K free), large programs can usually be written without a need to

EDTASM/Plus occupies the area from 4380H - 7265H, but source code is written from 71C9H, the remainder being one-time code. I use the area from 7266H - 72FFH, allowing the source code to begin at 7300H. I also use the area normally used by the Quash command. When I store programs auch as EDTASM/Plus on disk, i seve more memory than is necessary in order to recreate the original program environment as closely as possible without

leftovers from DOS. I do this by storing the contents of reserved memory from 4000H to the beginning of the program, together with the program itself. The modifications shown in the Program Listing can be applied by using the following sequence, using RSM2D as the monitor.

- 1. Loed RSM2D.
- 2. Reset with the breek key held down.
- Answer the memory size question with a specific value.
- 4. Type System.
- 5. Load EDTASM/Plus.
- Enter RSM2D by typing/entry address.
- Type in the changes shown in the Listing. (You must supply the hex velues of the text strings.)
- 8. Move the area 4000H-7305H to 5200H-8505H.
- 9. Press reset to load the DOS.
- 10. Dump the area from 5200H
- 8505H to disk, with either 84F0H or no transfer point.
- 11. If DOS trensfer is used, Dump 8500H - 8505H, and transfer 84F0H as a dummy source module.

The procedure for initiating the assembler (assuming DOS entry point) is now as follows:

- 1. Type EDTASM (if EDTASM iPlus is stored as EDTASM/ CMD).
- 2. Type the name of the source file to be loaded.

If 84F0H is used as transfer point for EDTASM, Load must be used for EDTASM when a source file is to be loaded immediately afterward.

When e source file is to be saved on disk, command Q is used (for Quit, instead of Quash) to move the source in memory and to display the values to be used for the Dump statement. Note these values since the screen will be erased as soon as the space key is depressed. The Dump command should be used as soon as DOS has been loaded. The source files are not directly transferable to other assemblers, although a conversion program could easily be written. The source could also be transferred via cassette tape.

Comments

The modifications may need a

few comments. I found that the Q command resides in the area 646CH - 64B3H. The command table address starts at 4659H, with one byte for the command code and two bytes for the address of the corresponding routins. These values should be checked before the modifications are applied. I used the EDTASM/Plus warm entry point (4383H), since source code is

present on entry. This entry skips the check for the end-of-memory address (normally all memory is used with no check for reserved memory), so this address must also be set up. I use this opportunity to reserve memory to advantage. I have a driver for an RS232 printer resident here, so it may be used with EDTASM/Plus. Also, I leave room for RSM2D or other code es re-

quired.

The source start and end addresses are stored together with the source code in the four bytes at 8500H. When command Q is used, the source code and addresses are moved in memory, but no check is made for mamory overflow. A check could be made that the new end eddress does not exceed the eddress in location 4236H, though it should

Program Listing.

					S TO ALLOW FOR STORING	
		; ASSENSI				
	98178	PROGRAI	MEO BY A	ARNE RONDE, STRUI	R, DENMARR, SEPTEMBER 19	88
8589					SOURCE IN NEMORY	
8592		8FSTAD BFENAD			STORE BUPPER START ADDR	•
0584	00170	DIEDEED	EQU		STORE SUPPER END ADDR	
EBPF	89179	BUPPER	EQU		HEMORY END, ROOM POR RS	M2D
	89188		240		:PRINTER DRIVER, ETC	
646C	88198		ORG		; C CONMAND AREA	
646C 2A3242			LD	646CH HL,(4232H)	END OF SOURCE PTR	
646F E5	89298 09218		PUSH	HL	STORE END ADOR	
6478 ED583842	89228		LO	DE, (4238H)	START OF SOURCE	
6474 D5	09238		PUSH	DE	STORE START ADDR	
6475 23	88248 88259		INC	HL	; INCLUDE PFFF END MARK	
6476 E5			PUSB		;STORE ADDR	
	80268		INC	HL		
6478 AF	88278		XOR	A	; CLR CARRY	
	88208		28C		; FIND MOVE LENGTE	
6478 44	98298		LD	В, Н		
647C 4D	98388		LD LD ADO	C,L	XYER TO BYTE COUNT	
6470 218385 6488 89	98318		TD.	HL, GUFFER-1	JUEST ADOR -1	
6401 EB	88328		EX	HL, BC	;+ LEH = END ADDR	
6482 El	88338 88348		POP	06,8L	DEST ADDR TO DE	
	89358		PUSS		; SOURCE ADDR ; STORE END ADDR	
6404 ED68	88360		LDDR		; NOVE TEXT	
6486 D1	88378		POP	DE	; END ADDR AGAIN	
6407 E1	88300		POP		START ADOR	
6400 228885			LD	(BESTAD) .HL	STORE WITH TEXT	
	98489		POP	HL	END ADDR	
	B8418		LD		STORE IT AS WELL	
	88428		LD	HL, TEXT+37	END ADDR TEXT	
			LD	A,D		
6492 7A 6493 CD6672	08448		CALL	CNVL	CONVERT NSD TO BEX	
6496 7A	98459		LD	λ,0		
6497 CD6A72	98469		CALL	CNVR	CONVERT LSO TO BEX	
649A 7B	98479		LD	A,E		
649A 7B 649B CD6672	99489				CONVERT MSD TO HEX	
047E /B	00470		LD	A,E		
649F CD6A72			CALL		CONVERT LSD TO HEX	
64A2 217772 64A5 CD3245 64A8	00530			HL, TEXT	. COTTON DO CONTON	
64A8	99534	WTENT		4532H \$; WRITE TO BCHEEN	
64A8 3A483B	00000	********	LD		; KEYBOARD MENORY	
	08550		DHA	80H	: ISOLATE SPACE	
64AD 28F9	88569		JR		NOT SPACE REY	
64AF C39898	98578		JP	8	BOOT SYSTEM	
				6483H, END OF Q		
	88590	;				i
	88688	; END OF	EDTASM .	- EXTRA MEMORY R	eserved	
7266	88618		ORG	7266H		
				TO HEX CHARACTE	R	
7266		CNVL		\$		
	89640		RRCA			
	88658		RRCA			
7268 8F	88660		RRCA		- NOUE HOD DO 185	
7269 8F 726A	88672 88688		BRCA EOU	s	MOVE MSD TO LSD	
726A E68F	88698		AND	\$ 8FH	- DEMOUS CHARACTER	
726C F638	89788		OB	38H	REMOVE UNWANTED	
726E PE3A	89718		CP	3AH	; CHECR ALPHA	
7278 3882	88728		JR		, sinden anena	
7272 C687	89738		ADO	C,HEXOX A,87H	CONVERT TO A-F	
7274		HEXOK	EQU	\$	CONVERT TO A-F	
7274 77	88758		LD	(HL),A	;STORE IH TEXT	
7275 23	89768		INC	HL	,	
7276 C9	88778		RET			
7277 8A8A	98788	TEXT	DEFW	8A8AH	; LF LF	
7279 44	88790		DEFN	'DUMP FILENAME		
					Program Listing conti	
					Frogram Listing Confi	# UCS

7294 27 98028 DEFE	Program	Listing co	ntinued			
7294 27 98028 DEFE	7288	27	99999	nera	27H	
7295 2C 80838						
7295 27						
7295 57						
7295 58						
72A1 2C						
72A7 27 808078 DEFN '.TRA=X' 72A7 27 808080 DEFN '.WASTATA 72A7 29 80916 DEFN '.WASTATA 72A7 29 80916 DEFN '.WASTATA 72A7 29 80916 DEFN '.WASTATA 72A7 29 80938 DEFN '.WASTATA 80950 DEFN BAH '.LF 80950 SENTRY POINT AFTER EDTASN MOVED IN HEMORY 80950 SENTRY POINT AFTER EDTASN SOOT '.TEXT TART SOUTH AFTER SO						
72A7 27						
72AG 27 88988 DEFM 74F8' 72AC 27 88988 DEFM 27H 72AC 29 88918 DEFM 1', 72AC 29 88938 DEFM 1', 72AC 28 8A 88958 DEFM 88978 ', 72AC 28 8A 88958 DEFM 88978 ', 72AC 28 8A 88958 DEFM 88978 ', 72AC 28 8A 88958 DEFM 88978 DEFM 88978 ', 72AC 28 8A 88958 DEFM 88978 ', 72AC 28 8A 88958 DEFM 88978 DEFM 88978 ', 72AC 28 8A 88958 DEFM 88978 DEFM 88978 ', 72AC 28 8A 88958 DEFM 88978 DEFM 88978 ', 72AC 28 8A 88958 DEFM 88978 ', 72AC 28 8A 88978 ', 72AC 28 8A 88978 ', 72AC 28 8A 88988 DEFM 88978 ', 72AC 28 8A 88988 ', 72AC 28 8A 88888 '						
72AC 27 89998 DEFS 27H 72AD 29 89918 DEFM ')' 72AE 80 89520 DEFM BAH ;LINE FEED 72AF 28 68938 DEFN '(SPACE) TO SOOT' 72AE 80 89958 DEFN BAH ;LF 720F 80 89509 DEFN BAH ;LF 720F 80 89509 DEFN BAH ;LF 72CF 80 89509 DEFN BAH ;LF 72C8 318043 89998 LD SF,4388 ;STACK FOR EDTASM 72C3 2A8085 81808 LD SF,4388 ;STACK FOR EDTASM 72C3 2A8085 81808 LD HL,(SPSTAD) ;TEXT START ADDRESS 72C4 223242 81809 LD HL, (SPSTAD) ;TEXT START ADDRESS 72C5 223042 81809 LD HL, (SPSTAD) ;TEXT START ADDRESS 72C0 223242 81850 INC HL 72C1 223242 81850 INC HL 72C2 23242 81850 INC HL 72C3 234885 S1808 SSC HL,DE ;LENGTH FOR MOVE 72D3 255 81809 SSC HL,DE ;LENGTH FOR MOVE 72D3 255 81809 SSC HL,DE ;LENGTH FOR MOVE 72D3 255 81809 SSC HL,DE ;LENGTH FOR MOVE 72D4 640 81180 LD C,L ;STORE IN SYTE COUNT 72C7 218485 8116 LD HL,SUFFER ;START OF MOVE 72D4 2D6 81109 LD C,L ;STORE IN SYTE COUNT 72D7 218485 8116 LD HL,HENEND ;EDTASM END ADDR (MODIFY 72D7 223642 81140 LD (4236H),HL ;STORE EDTASM FOR MOVE 72D8 223642 81140 LD (4236H),HL ;STORE EDTASM FOINTERS 72D7 223642 81140 LD (4236H),HL ;STORE EDTASM FOINTERS 72D8 72F8 81120 JP 4383H ;ENTRY TO LEAVE TEXT SUF 72P8 91 81290 ;CODE ON ENTRY WHEN TEXT LOADED 72P8 91 81290 ;CODE ON ENTRY WHEN TEXT LOADED 72P8 91 81290 ;CODE ON ENTRY WHEN TEXT LOADED 72P8 91 81290 ;CODE ON ENTRY WHEN TEXT LOADED 72P8 91 81290 ;CODE ON ENTRY WHEN TEXT LOADED 72P8 91 81290 ;CODE ON ENTRY WHEN TEXT LOADED 72P7 110040						
72AE 0A				DEFM	'04F0'	
72AF 28 68938 DEFM (SPACE) TO SOOT (SPACE) TO				DEFS		
728F 28			00918	DEPM	') '	
72eE 8A			00920	DEFB	ØAH	;LINE FEED
720F 88	72AF	20	00930	DEFM	'(SPACE) TO 8	TOO
720F 88	72eE	ØA	00940	DEPB		
	72eF	00				
						, Illustry, and I care
72C8				ים העותם עמה	PACE COASM MO	CD IN MEMORY
72C8 318843 88998 LD SP,43888 ;STACK FOR EDTASM 72C3 2A8885 81808 LD HL,(8PSTAD) ;TEXT START ADDRESS 72C6 223842 81808 LD HL,(8PSTAD) ;TEXT START ADDRESS 72C6 223842 81808 PUSH HL ;STORE IN EDTASM 81828 PUSH HL ;STORE IT 81828 PUSH HL ;STORE IT 81828 PUSH PUSH HL ;STORE IT 81828 PUSH PUSH PUSH PUSH PUSH PUSH PUSH PUSH	72C#		ANGNA SEC	TN FOU		GD IN HENORI
72C3 2A8885 81888 LD HL, (8FSTAD) ; TEXT START ADDRESS 72C6 223842 81818 LD (42381), HL ; STORE IN EDTASH 72C9 E5 81828 PUSH HL 72CA 2A9285 81838 LD HL, (8FSNAD) ; TEXT END ADDR 72CD 223242 81848 LD (42321), HL ; STORE IT 81828 POST 72DB 23 81858 INC HL 72DB 23 81868 INC HL 72DB 23 81868 INC HL 72DD 23 81868 INC HL 72DD 23 81868 INC HL 72DD 24 81828 POST 72DD 25 81828 POST 72DD 25 81828 POST 72DD 26 91888 POST 72DD 26 91888 POST 72DD 26 91888 POST 72DD 27 18 18 18 18 18 18 18 18 18 18 18 18 18		318843				OMECH TOO GOVERN
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72CD 223242						
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2224 240	0000		RTTAR	END		

be obvious from the values in the displayed message. The initial values stored at 7300H are used to initialize the source program area if no source program is to be loaded; they will be overlaid if a source program is loaded before executing the essemblar.

The solution I chose is not ideal for converting programs to run on DOS systems, but it is reasonably easy to implement. The alternative would be to purchase a more expensive macro assembler and forget all about Z-Bug or to attempt both a relocation and a modification of EDTASM/Plus to allow it to be resident with DOS. With those alternetives, you can easily live with a few shortcomings!

I implemented the modifications using NEWDOS/80 and RSM2D, but I can see no reason why they should not work with TRSDOS as well. In fact, the format of the message with the Dump parameters has been coded in the TRSDOS format rather than the NEWDOS/80 format, which, incidentelly, is much simpler.

The principles of these modifications are also applicable to other programs; I have converted Tiny Pascal to work with disk storage for source and P-code. It is now much faster and it is much more reliable than using tape.

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WORD: RESPONSE:

(Your error)

Correcting MICROPROOF Screen Display

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HIT <ENTER> KEY

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DISK SPACE REQUIRED FOR DICTIONARY	70,000 BYTES (fits easily on one 514" disk)	170,000 BYTES
DICTIONARY ENLARGEMENT	VIRTUALLY UNLIMITED	EXTREMELY LIMITED
SPEED-400 Words	20 Secon d s	1 to 5 Minutes
SPEED-3,000 Words	1 M inute	2 to 10 Minutes
CORRECTION FEATURE	Optional	Not Available

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An easier way for data entry.

Formatted Screen Input

F. Christian Byrnes 83 Fairmount Ave. Hackensack, NJ 07601

Intering moderate volumes of data into the TRS-80 can be frustrating. A Basic program displays a prompting message which requests the input of one or more fields of data. If more than one field is to be input, the operator must know to use a comma between them.

Terminals attached to large systems enjoy the advantage of formatted screens. The operator sees the acreen as being divided into headings or titles and input fields. Data corresponding to each heading is entered following its heading and the cursor jumps from one field to the next as the data is entered. All of the headings remain unaltered in place until all of the data for that screen have been entered.

Initially the TRS-80 does not appear to allow us the luxury of a formetted screen, but a little fancy footwork can change the operator's view of the computer drastically.

Overview

This program listing is an example of the formatting and input routines imbedded in a driver program to demonstrate how they may be used. Screen formatting is performed by the routine in statements 1100 and

1110 using arrays OS and OS\$. Array OS contains, in element zero, the number of field headings in this screen. Each element of the array thereafter contains the screen starting position of a heading. The elements of array OS\$, starting with element one, contain the text corresponding to the positions specified in OS.

Input Is accepted by a call to the routine at statement 900. This routine selects the next element from array OM and calls the subroutine at statement 1000 to position the cursor and read the keyboard. Array OM has two dimensions. Each element pair consists of a starting position and length for an input field. Element (0,0) contains a count of input fields for this screen. The accepted data is returned in variable OB\$. Variable OE contains a pointer to the next element of OM.

Logic

The example program shows how to use these subroutines. Line one dimensions the required errays. Line 10 and 20 loed these arrays from data statements. In a disk system this information could easily be read from a file.

Line 30 calls the screen formatting subroutine. Upon return all of the headings have been placed in their proper positions on the screen.

Line 35 calls the screen input procedure at line 900. Line 910 tests variable OE. The number of the next array element of OM to be used as location and length of the input field is contained in OE. The calling program could change this value prior to a call in order to skip or repeat a field. If such a function is to be used, a device such as T-Beep would be needed to alert the operator to the change.

Lines 920 and 930 set internal variables XP and XL equal to the referenced elementa of

array OM end ere followed by a call to the subroutine at line 1000. This method was chosen so multiple format and input tables could be used within a single program. Modified versions of lines 900 to 960 could be coded in a single program, each for a different screen format, and all could call line 1000 for input.

- 1000 begins the keyboard input routine.
- 1001 sets OB\$ to null.

```
1 CLERR1580:DIM ON(25,2),OS(50),OS$(50)
5 DIM AAS(25)
10 READ ON(0,0):POR OH=1 TO OM(0,0):READ OM(OM,1),OM(OM,2):NEXT
20 READ OS(0):POR OH=1 TO OS(0):READ OS(OH),OSS(OM):NEXT
30 COSUB 1100
35 GOSUB 980
48 AAS(OE-1)=OBS
50 IF OE<0M(0,0) THEN 35
60 CLS:PRINT "THANK YOU"
70 'PROCESSING ROUTINE COES HERE
80 FOR N=1 TO OE:PRINT AAS(N))" ";:NEXTH
85 NS=INKEYS:IF LEN(N):90 THEN 85
90 GOTO 30
900 'INPUT ARRAY DRIVER
910 IF OE=0 OR OE>OM(0,0) THEN OE=1
920 XF=OM(OE,2)
940 GOSUB 1000
950 QE=OE+1
960 RETURN
1001 OBS=""
1002 PRINTEXP,CNRS(14);
1004 FOR OC=1 TO XL
1005 OAS=INKEYS:IF LEN(OA$)=0 THEN 1005
1012 IF OAS=CHRS(3) THEN GOSUB 1050:GOTO1005
1012 IF OAS=CHRS(3) THEN OAS=CHRS(32)
1015 IF OAS=CHRS(3) THEN OAS=CHRS(32)
1016 IF OAS=CHRS(3) THEN OAS=CHRS(32)
1017 IF OAS=CHRS(3) THEN OAS=CHRS(32)
1018 IF DAS=CHRS(3) THEN OAS=CHRS(32)
1019 IF OAS=CHRS(3) THEN OC=1:RETURN
1050 'BACKSPACE KEY PRESSED
1051 IF LEN(OBS)=0 THEN OC=1:RETURN
1060 OBS=LEFTS(OB$,LEN(OBS)=1):PRINT CHRS(8);
1061 OBS=LEFTS(OBS,LEN(OBS)=1):PRINT CHRS(8);
1062 CLS:FOR OH=1 TO OS(0):PRINTEOS(OM),OSS(OH):NEXT
1110 RETURN
1060 CLS:FOR OH=1 TO OS(0):PRINTEOS(OM),OSS(OH):NEXT
1111 RETURN
1060 DATA 15,280,40,272,44,336,15,359,2,367,5,459,3,463,3,467,4,467,4525,440,671,8,735,8,841,55,969,55,969,55
9010 DATA 11,81,SANPLE DATA COLLECTION SCREEN,192,ACCOUNT NAME,2
476,4,4525,440,671,8,735,8,841,55,969,55,969,55
9010 DATA 11,81,SANPLE DATA COLLECTION SCREEN,192,ACCOUNT NAME,2
64,ADURESS,328,CITY,353,STATE,363,ZIP,448,TELEPHONE ( ) EXT:
9011 DATA 512,REFERRED BY,652,PIRST ACTIVE DATE,716,LAST ACTIVE
DATE,032,COMMENTS
```

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"The standard TRS-80 method of accepting input from its operator is about as efficient as punched card input."

- 1002 turns on the cursor in the first position of the input field.
- 1004 counts the number of characters Input up to the maximum fleld length.
- . 1005 accepts one character.
- 1010 Is used if the character is a backspace. Go to the subroutine at 1050 (see below), then go to 1005.
- 1012 is used if the character is a forward arrow; turn it into a space and continue.
- 1015 is used if the character is the enter key, then the field is complete, so make the field length equal the maximum field length and then go to line 1030.
- * 1019 is used if the character is neither alphabetic nor numeric; discard it and accept the next character by

going to line 1005.

- 1020 appends the character to the previously accepted characters and displays it on the screen.
- 1030 repeats until the maximum field length is achieved, then turns off the cursor and returns to line 950.

Line 950 increments OE to point to the next element of array OM in preparation for the next call to this routine. It then returns to the celling program with variable OB\$ containing the requested input string.

The subroutine at line 1050 is called from line 1010 if the input character is a backspace. Line 1055 handles a backspace from the first position of a field and prevents the cursor from moving into the title field. Lines 1060 and 1065 handle all other backspace conditions followed

by a return to the input processing in the middle of line 1010.

Usage

In this example the calling program consists of lines one through 90 and provides no function other than data accumulation of a single screen. Rudimentary validation of the contents of OB\$ between calls to the input array driver at line 900 is possible, but more extensive processing could cause the operator to overrun the input capabilities of the program. Any delays caused by input/output should be isolated to the time between screens or even better, after all input is complete. This, of course, will depend upon available storage.

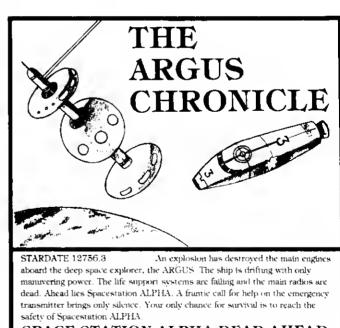
Summary

The structure of these rou-

tines was chosen to facilitate their usage in as many programs as possible. This building-block approach will help to speed development of future programs. In keeping with this design technique, we have designated certain variables as belonging to common routines. The letters O and X are the initial letters of all variables within these routines. Additionally, although this listing does not demonstrate it, we have reserved variables starting with the letter Z for binary flags

Data collection is an important part of many applications. The standard TRS-80 method of accepting input from its operator is about as efficient as punched card input. These routines could speed up file building.





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A loop in a nest slows you in a rush.

Thoughts on For...Next

Richard Amyx 994 North Second St. Sen Jose, CA 95112

A while ego I was tinkering with a little game I'd found in a book, the glet of which was to keep tabs on a nine-element array and to toss out array elements as certain conditions were met. The listing was rela-

tively short and had no terribly complicated statements, so I keyed it in without paying much attention to what was going on within the program.

The routine was query/response, next query/response, and so on, with virtually no time lag between my responses and the next query—until the fifth or sixth response, at which point the program appeared to take off into outer space. After waiting a reasonable length of time I broke out of the program and proofread my keypunching around the break—no errors.

So I tried again and got the

same result. But this time I decided to wait the machine out. When I eventuelly returned to the computer, I found that the program had indeed gone on as it should heve. Why, I wondered, the sudden quentum leap in time between response and query?

i then looked at the program more closely where I'd broken out of it the first time, and found that the break had been in the middle of a sequence that looked like this:

> 10 FOR I = 1 TO 6 20 FOR J = 1 TO 9 30 FOR K = 1 TO 6 40 FOR L = 1 TO 9

100 NEXT L 110 NEXT K 120 NEXT J 130 NEXT I 140 GOTO xxx

It didn't take too much button-punching to learn that if this nest of For loops went all the way through it would require $7380 (9 + 9^2 + 9^3 + 9^4)$ total iterations. Combine that

with a couple of if statements in the middle, end you can bet you're going to have to wait for a response.

Then looking at the program even more closely, I decided that it would require very little housekeeping to reduce the length of the array, and hence the upper limit of these For statements, as the game progressed. I wondered how much time could be saved if this one change were made. The givens were that the For loops would remain four deep end that the equation for the total number of iterations required was Y = $N + N^2 + N^3 + N^4$, where N was the upper limit of the For loop. A little more buttonpunching yielded the numbers in Teble 1.

The numbers of iterations themselves ought to be impressive—certainly they're big enough—but what's even more important are the differences between them and the percentage of maximum time those differences represent. This is

Upper Limil	Total Herations	% of Maximum
9	7380	100.0
6	4680	63.4
7	2800	37.6
6	1554	21.1
5	780	10.6
4	340	5.6
3	120	1.6
2	30	0.4

Table 1. Four-deep For loops.

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most strikingly litustrated by a graph (see Fig. 1).

As you can see, once you get past an upper limit of six you're going to be making some very powerful time trade-offs for every increment in the upper limit of the loops.

Getting back to the game, it appeared that the program usually wouldn't get into the heavy looping sequence until at least the third response, which meant that the upper limit could have been reduced from nine to seven and that a 62 percent saving in time might be realized. The next step, of course, was to test my hypothesis.

To do this, I wrote a short program just like the example sequence shown, filling in the dots with a couple of donothing if statements to increase overall execution time and thereby reduce the effect of my own reaction time on the

stop watch. The results i got were (N again representing the upper limit of the loop index):

> N = 9, 1 = 46 sec N = 8, 1 = 29 N = 7 t = 17

This was close enough to prove the theory. The execution of a very slow portion of the program could indeed be speeded up by at least 62 percent just by indexing the upper limits of the four For loops.

The rule is simple: The amount of time it takes to execute nested For...Next loops increases by the power of the depth to which the loops are nested—two-deep loops, time squared; three-deep loops, time cubed; and so on. Obviously, the best solution is not to nest For loops any deeper than absolutely necessary, but if you must nest them deeply, then pay very close attention to the ranges of the loop indices.

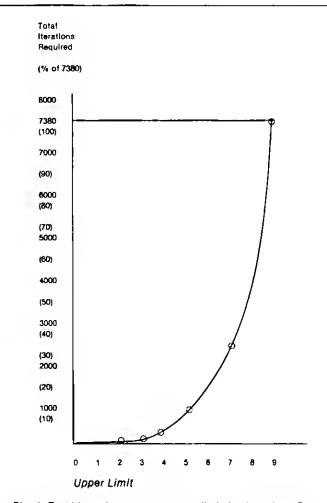


Fig. 1. Total iterations versus upper limit for four-deep For loops.

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Can you say "data?"

Datafix

A. J. Barnard, Jr. J.T. Baker Chemical Company Phillipsburg, NJ 08865

A. D. Barnerd Rensselaer Polytechnic Institute Troy, NY 12181

The TRS-80 keypad can help you whenever you're entering programs with long data statements—for example, music and graphics programs, science programs or long data lines to be POKEd into machine-code routines.

The keypad, you say, only allows you to use ten digits, a period (decimal point) and the enter key. You'll still have to enter the word data, any necessary commas and minus eigns from the keyboard.

Not necessarily. With the following routine, you can

translate two or more consecutive periods into the word data, a comma, or a minus sign. Datafix is a Basic routine for a Model I Level II TRS-80 that gives you the proper syntax from the keypad, using only four variables.

Changing Code

If you enter two consecutive periods after a line number, Datafix recognizes that the line is a data statement and, by POKEs, changes the first period to the word data (internal code 136) and the second to a space (32).

At any further point in the statement, if you enter two consecutive periods, the routine changes them to a comma (44) and a space (32). If you enter three consecutive commas, the third is converted to a minus sign (45). The routine ignores any periods within quotation marks and leaves a space after

the word data and between each item.

For example, you can enter the following lines, except for alphabetic and special characters, using the keypad only:

> 100..10.1..40.2 105...10.1...40.2 110..JONES..40.2 115.."6YE NOW..."...10.1

Upon enterning: RUN 1, Datafix converts these statements to:

> 100 DATA 10.1, 40.2 105 DATA = 10.1, = 40.2 110 DATA JONES, 40.2 115 DATA "BYE NOW...", = 10.1

and then advise you that the data statements were corrected.

As written, you can load Datafix before your program. You can also renumber the routine to, say, 60001-60006 and append it to a program in memory (see, for example, 80 Microcomputing, January 1981, p. 213 for the PEEK/POKE approach).

If you are entering and editing statements only once, you can delete the routine after you use it.

How It Works

In Program Listing 1, we use line feeds and indents to make the logic clearer. Dropping this nicety, reduces memory requirements. Line 0 bridges the routine and returns to the main program at line 10.

Line 1 returns the decimal ad-

dress, ZX, of the first line of a Basic program.

Line 2 first checks the two bytes of the line pointer; if they equal zero, the routine goes to line 6 and ends. Line 2 also checks for a period immediately following the line number; if none exists, the line is not a date stetement and the routine passes to line 5.

Finally, line 2 can also start a character-by-character PEEK of a statement to be edited. When it meets character zero, Datafix has reached the end of the line, and passes to line 5.

If line 2 finds that the first two characters of a program line are periods, the periods are changed to the codes for the word data and a space. ZU is set to the character position I.

Line 5 finds the address of the next program line and returns to line 2.

Line 3 checks for a quotation mark (code 34). If one is found, flag ZV is set and Datafix will not check for periods until either a second quotation is encountered or the line ends.

If Datafix finds two consecutive periods beyond the start of the data statement, but not within quotation marks, line 4 changes them to e comma and a space, and ZW is set to the character position 1.

Then, if the routine meets e third period and confirms it as consecutive by i being equal to ZU + 1 or ZW + 1, it is converted to e minus sign. ■

```
### GOTO18

1 IX-PEEK(18548) +256*PEEK(16549)

2 IF(PEEK(1X)+PEER(1X+1)+#]*HEN6

ELSEIPPEEK(1X+4)<A6THEN5

ELSEIU-8: 1X-8: 1X-8:

ELSEIU-8: 1X-8: 1X-8:

ELSEIF(1=2X-5AHDPEEK(1)-10-16HEN5

ELSEIF(1=2X-5AHDPEEK(1)-12-16HENY-1-1HENT

IF(1X-8AHDPEEK(1)-13-17HENY-1-1HENT

ELSEIF(1X-1ANDPEEK(1)-34) THENIX-1-1HENT

ELSEIF(1X-1ANDPEEK(1)-34) THENIX-1-1HENT

ELSEIF(1X-1ANDPEEK(1)-13-17HENIX-1-1HENT

ELSEIF(1X-1ANDPEEK(1)-13-17HENIX-1-1HENT

ELSEIF(1X-1ANDPEEK(1)-13-17HENT-1-1HENT

ELSEIF(1X-1AHDPEEK(1)-13-17HENT-1-1HENT

ELSEIF(1X-1AHDRENT-1-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1-1HENT-1
```

Program Listing 1. Datafix Routine

358 • 80 Microcomputing, October 1981

Are my TRS-80* business systems really that good? Michael Tannenbaum thinks so.

Here's what he said about my Model II systems in the August "80 Microcomputing."

On the General Ledger's ability to file and report:

"...the best I have yet seen in a microcomputer system."

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"...the first time I have seen this feature in a microcomputer system."

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Strengthen NEWDOS 80's chain command.

Weak Link

Steven Denholtz, D.M.D. Livingston Professional Building 114 West Mt. Pleasant Ave. Livingston, NJ 07039

Unlike its use under Newdos80, the Chein function usually exits and erases e resident Besic program, then Inputs another Besic program from disk. This program, in turn, operates on a still resident set of veriables and/or flies that are shared by related programs. The retionale is to reduce the amount of user memory the program consumes so a larger share of memory can be used for date or variables.

In Newdos80, however, the Chain function performs an entirely different operation. A short Basic utility is provided here so you can use Chain with speed end ease not evallable under Newdos80.

What is Chain?

Chain is e DOS library command. After e Chein command, anytime a progrem esks for input from the keyboard, the keyboard record will eutometicelly be supplied from a disk chain file without any operator action. How did the keyboard enswers get on the disk? How does the computer know where to look? To answer these questions, let's learn e few new

terms and look at what e chain file is:

Chain File: Section0
Section1
Section2
....>etc. til EOF

Syntax

Eech section is an Independent subfile of keyboard responses. Multiple sections can share the seme file name. This avoids wasting a whole granule of disk space (1.25k) for each group of keyboard responses that usuelly takes a few words (100 bytes maybe). Thus the chain file was designed to heve sections that are really independent subfiles sharing one filespec. This saves valuable disk space. You address the section when you issue the Chain command:

2a. 'CHAIN filespec <SECTIONn>' If in Dos; or,
2b. 'CMD''CHAIN filespec <SECTIONn>"' If in Disk Gasic.

SECTIONN is optional on the first section (0). If the chain file contains more than one section, you must specify which one you are addressing, where n is a positive integer. If SECTIONN is deleted when issuing the Chein command, the default neturally is the first section, SECTIONO. The filespec in Fig. 2 has a defeult extension of JCL, (which stands for Job Control Lenguege, but thet is

getting beyond the scope of this article).

Section: <a href="#section-color: blue-color: color: color: blue-color: color: color: blue-color: color: co

The special character is elways one of the following:

CHR\$(128) (80 H): start of a new Section CHR\$(129) (81 H): display message, swalt ENTER before proceeding CHR\$(130) (82 H): chain file "remerk" CHR\$(131) (83 H): display message, no pause

The special character 128 (80 Hex) is mandatory when sterting a new section, except for the first section. All other cheracters are strictly optional. But, after using a CHR\$(128) to stert a new section, you must elso put SECTIONn Immediately after it so you can later address which subfile (or section) you wish to use when you invoke

Chein, as shown in Fig. 2.

Usas of Chain

The keyboard record is the answer that will be displayed on the screen and used as if it were actually input from the keyboard (see Fig. 3). This can aupply a commonly used set of parameters to an often used utility. More often, it may be a series of System and Basic commands implementing a complex program such as shown in Fig. 5.

My diskettes include e "JCL-JCL" file to be used in an Auto boot mode—every diskette, that is, but my Newdos80 system diskette. That one has the Auto command: AUTO CHAIN JCL/JCL, but has no file named JCL/JCL. This way, whenever I use my computer, I simply place either the system diskette or my application

LCDRIVER BASIC LOAO"LEDGERB" CLS LIST1 LIST10030-10040 EDIT10040

DOS READY

CHAIN JCL/JCL:1
DOS READY
LCDRIVER
GENERAL PURPOSE LOWER CASE DRIVER
DOS READY
BASIC
DISK BASIC. RADIO SHACK'S ROM ENCHANCED WITH APPARAT'S NEWDOS80
EXTENDED AND DISK FEATURES.

Flg. 5 A Typical Use of Chain.

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- Super fast sort by alph, or zip order (8 sec. for 1000) entries)...both orders can exist simultaneously on disk.
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- In zip order all entries with same zip code are also arranged alphabetically.
- Four digit zips have a leading "0" appended on labels
- Backup data disks are easily updated as entries are created, edited, or sorted .. extremely useful!!
- Optional reversal of name about comma for that noncomputer, personalized look.
- Master printouts of your list in several formats (not just a rehash of the labels). Optionally continuous or page oriented Your customers will want this!
- All 0's in address labels are replaced by easier to read 0's.
- All labels optionally support an "Attn:" line.
- Many user defined fields with plenty of options for simultaneous purging and selecting even allows for inequalities .. powerful and easy to use!!
- Continuous screen display of how many addresses currently printed.
- Each disk entry automatically "remembers" how many mailings have been made for that particular entry...Can be tied in with purge/select.
- Primarily written in BASIC for easy modification... embedded machine code for those speed sensitive areas.
- Editing is simple and fast, automatic search.
- Optional 9 digit zip.
- Deleted entries have "holes" on disk filled automatically ...and alph-order is still mainfained!
- Test label printing lets you make horizontal and vertical adjustments with ease.
- Optional "one time" mailing for some selected entries.
- Extensive use of error traps (both operator and machine induced)...even recovers from a power failure during a printout!
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- Hardware requirements: 32K, printer, and 1 or 2 disk drives

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- Extensive error traps ...won't let you make an error
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- Hardware requirements.. 32K, 1 disk driver and printer

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know assembly language programming to use these two programs. Just use your disk to merge our short basic programs. (with embedded machine code) with your own basic program Follow our simple instructions to poke only 2 values before making the user call from basic. The pokes will set up a sort for string, integer, single, or double precision arrays. Also ascending or descending order is controlled by a single poke. Use one of two programs to sort arrays of the form A(1) or A(Q(1))...The disk includes six simple basic programs that are ready to merge with the main sort programs. Use them for learning and evaluation . Also included is a ready to use basic program (already merged with the ORDER program). Use it to obtain a printout of alphabetized names.

Sample Sort Times

8 sec. for 1000 dbl prec. numbers...50 sec. for 5000 integers Time for alphabetizing (string sorting) is comparable but dependent on the length of the strings

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diskette in drive zero and hit reset. The chain file issues all commands necessary to place my computer in a state where I can sit down end set to work. This may include listing any particular program lines that I feel need further development, or placing chain file messages

to remind me where I left off, and even entering the Edit mode already pointing to a troublesome line.

Lest Minute Hints

The operator may terminate the Chain command any time by pressing the up-arrow; the operator may force a Chain pause by holding the rightarrow, and continue by pressing (enter).

An Original Utility to Craata Chain Flies

Program Listing 1, Makeicl/bas, creates and appends chain files with every feature described so far fully implemented. Study the program with its remarks. Type it into your system and save it on your Newdos80 system diskette. You will undoubtedly use it often and perhaps come up with your own applications.

```
219 PRINT"
                                                                                                                                                                                            *** END ****
                                                                                                                                                                228 END
389 'MUST LOOK UP LAST SECTIONID, ADD ONE TO 1T THEN GOTO358
                                                                                                                                                                318 OPEN"1",1,FILE$
315 INPUT01,ps
320 IFASC(D$)=128 THEN SECTINID =SECTINID+1
  "MAXEJCL/BAS" - BY STEVEN DENNOLTZ, B.S., D.M.D.
COPYRIGHT 1988 ALL RIGHTS RESERVED
                                                                                                                                                                325 IP NOT EOF (1) THEN 315
338 SECTINID=SECTINID+1:PRINT@178, ******* SectionID=";SECTINID
5 CLS:CLEAR488:PRINT "MAKEJCL/BAE - Wall Care."
file to be used by CHAIN
by Steven Denholtz, D.H.D. (261) 347-1277"
                                                                                                                                                                16 D$="RENERHANDERNERHERENERHERE":D1$="NEUMNEUMNEUMNEUMNEUMEE"
38 PRINT"
                                                                                                                                                                377 GOSUB600 : 'interpret first character for special meaning 380 PRINTEL,DIS+DS : 'Put it into the disk Chain file. 395 GOTO150
 ":LINEINPUT"Fileapec (NO error checking I MUST have '/jcl' exten
:7",FILES
49 INPUT*Opening (O) a new file ,Appending last record (A) or new SECTIONid (N) ";D$
45 IF D$="N"OR D$="n" THEN 388
47 IF D$="0" OR D$="0" THEN 488
59 OPEN*E*_1,FILES: 'open to append to existing record.
188 PRINT@648,CRRS(255)+CRRS(255);PRINT@648,"
185 GOSUB 580;PRINT@648,"";:LINEINPUT*DOS OF DISK BASIC Command
7 ";D$
                                                                                                                                                                395 GOTO158
399 END
488 OPEN*0*,1,FILE$ :' open a new file (this will erase an exist ing file with the same filespec !)
428 GOTO188 :' pretty up the screen
588 FORX*=736T0922TEF64:PRINTEX*,*.";:NEXT:PRINTE739,*(,) user comment with peuse*;:PRINTEX83,*(.) user comment*;:PRINTEX867,*(/) file comment*;
? ",DS
118 GOSUB680 :' Interpret first character for special meaning
129 PRINT#1,DS :" Put it into disk chain file.
150 PRINT#784," ;:LINEINPUT"Enter snother command (Y/N) ",DIS
160 IF DIS="y" OR DIS="Y" THEN 188 ELSE 208
208 CLOSB
                                                                                                                                                                638 'Interpret first character of Command
618 IF LEFT$(D$,1)="," THEN D$=CHR$(129)*D$
628 IF LEFT$(D$,1)="," THEN D$-CHR$(131)*D$
638 IF LEFT$(D$,1)="," THEN D$-CHR$(131)*D$
                                                                                                                                   Program Listing 1
```





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A machine-code subroutine to dump memory on your display.

Memory Window

Warren Merkey 824 S.E. 1st Avenue Gainesville, FL 32601

ow you can view any 1024byte block of memory in your Model I Level II keyboard all 32 K. Memory window dumps memory onto the screen using a machine-code subroutine (a USR).

Here is how the program works. Line 1010 tells the computer where the USR is located and elso makes all variables Into integers. Line 1020 is the USR in the form of decimal date. Line 1030 loads the USR into place in high memory. Line 1040 asks the user for a place to stert. Line 1050 cells the subroutine that moves memory onto the screen. Lines 1060-1080 ere a loop that looks for control key input (arrow keys, Enter, and space bar). Line 2000 prints the current value of M in the upper left corner of the screen, with an arrow pointing to M. Line 9000 keeps the value of M within the first 32K of memory. Line 9010 celculates decimal POKE values. '(This will be explained below.) Line 9020 POKEs the address of the memory block to be displayed into the USR and then calls the USA.

The USR consists of 12 bytes of code, in which the BC, DE end HL register pairs are loaded with the block-move parameters, which is done by the LDIR instruction. As the display scrolls the HL pair is

the only one changed but the BC end DE peirs can elso be easily changed. With these 12 bytes of code and some skillful POKEIng, you can move eny part of memory to any other location. By POKEing a 184 where there is a 176 (BO hex). you change the LDIR to LDDR. This is sometimes necessary when moving a block of memory into an overlapping area, where the direction of the move would cause memory to be overwritten before it is moved. (Refer to "Now You See It" in 80 Microcomputing, February 1981 for another application of the 12-byte LDIR subroutine.)

To use this program, respond to the Memory Size question with 32512 to protect the USR. Key in the program as lieted and save it on tape before running it. The program may bomb

when it scans through certain sensitive areas of memory. The four errow keys give you scrolling in the four directions. The enter key sllows you to stop end pick another starting place. The space bar causes the current memory location (and ASCII value) to be printed in the upper left corner.

In line 9010, the POKE values must be decimal, although they are related to hexadecimal. Take the value 32600 which equals 7F58 hex. The 7F is the Most Significant Byte and the 58 is the Least Significant Byte. The LSB and MSB converted back to decimal are POKE values 88 and 127. These values are POKEd into memory locetions 32519 and 32520 read by the machine-code program as 7F58 hex.

Note that a hex number is translated to decimal by multi-

plying the values of its digits. 7F58 hex translates as 7×4096 + $F \times 258 + 5 \times 16 + 6 \times 1$ equals 326000. Remember that F equals 15. To reverse the procedure, you begin by dividing by 4096. The first two statements of line 9010 are long division:

```
7 = 1 	 (1 = INT(M/4096))
4096\overline{)32600}
26672
3928 = J. 	 (J = M - 1^4096))
```

The third and fourth statements are long division by 256:

```
15 = K (K = INT(J/256))
256)3928
3840
88 = L. (L = J - K*256)
```

The next divisor would be 16; however, as you can see, 88 is the decimal POKE velue we need for the LSB. This leaves us with e seven and a 15, which we know is 7F hex, a one-byte number. If we multiply seven by 16 and add 15, we get 127, the decimal equivalent of 7F hex. This last step is expressed as $H = K + 16^{\circ}I$. Lines 9000-9020 ere executed every time you press an arrow key. The USR reloads the entire screen with memory in the blink of an eve. giving the illusion of scralling.

I have used the algorithms in this program to bulld a memory editor which works reasonably well as a word processor. At the very least, Memory Window may impart some knowledge to those of you who can grasp its principles.

```
1000 "MEMORY WINDOM
1010 POKE16526,01POKE16527,127:DEFINTA-2
1020 DATA 1,0,4,17,0,60,33,0,0,237,176,201
1030 A=32512:FORB=0T011:READE:POKEA+B,CINE
1040 CLS: INPUT"STARTING POINT (0 - 317431"; M
1060 C=PEEK (14400): 1FC=OTHEN1060ELSE IFC=BTHENM=H-64
1070 IFC=16THENN=H+64ELSEIFC=32THENN=H-1ELSEIFC=64THENN=H+1
1080 IFC=1TNEN1040ELSEIFC=128THEN2000ELSE1050
2000 PRINT21,CHR#(93);"-";|||PEEK(H);||GOTD1060
9000 IFM:OTHENM=OELSEIFH>31743THENM=31743
        I=INT(M/4096):J=M-184096:K=INT(J/256):H=K+1681:L=J-K8256
9020 POKE32519, L:POKE32520, H:X=USR(0):RETURN
USR ASSEMBLY LISTING
                           00100
                                                32512
                                                                   LUSR ADDRESS
7F00 01 00
7F03 11 00
7F06 21 00
7F09 ED B0
7F08 C9
        01 00 04
11 00 3C
21 00 00
                                                                   LENGTH OF BLOCK
START OF SCREEN MEMORY
POKED FROM BASIC PROGRAM
                                      LD
                                                 BC, 1024
DE, 15360
                           00110
                          00120
00130
                                       LD
                                                 HL.O
                                                                   BUDCK-MOVE INSTRUCTION
RETURN TO BASIC
LEND ASSEMBLY PROGRAM
                                       LDIR
                                          Program Listing
```

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PRINTER PORT	YES	\$85	YES
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VIDEO MONITOR	YES	YES	725
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HUMERIC KEY PAD	YES	Ю.	TES
8/N GRAPHICS, 128 X 48	YES.	YES	YES
HI-RESOLUTION B/W GRAPHICS, 480 X 192	YES	NO	110
HI-RESOLUTION COLOR GRAPHICS (MISC), 128 x 192 IN 8 CDCORS	YES	MO	NO
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RELOAD 80

Many of our readers have called with questions about Color Computer programs and LOAD80. Some wanted to know if Color Computer programs were on the tapes, others wondered if they could load the LOAD80 programs into their Color Computer, alter them and run them. This month, we'll clear the air about the Color Computer.

First, the Color Computer programs we publish in the magazine are not on the LOAD80 tapes. This is because the Color Computer downloads data at 1500 beud only. LOAD80 tapes are recorded at 500 baud so they can be used by both Model I and Model III users. LOAD80 tapes with programs recorded at different baud rates cannot be duplicated by our high speed duplicator.

You cannot load the LOAD80 tapes into the Color Computer

for two reasons: one, the baud rates are different, and two, the Color Computer uses two separate tone pulses to output data—one to indicate a binary 1, the other to indicate a binary 0. The Models I and III use a single tone pulse that is either on or off to indicate the respective binary 1 or 0. For these reasons, the Color Computer and LOAD80 are incompatible.

Of course, you can still modify the programs in 80 Microcomputing to comply with Color Basic, and then type in the listings.

At the moment, there are plans afoot to put together a collection of the magazine's Color Computer programs in a special edition, Color LOAD80. This special edition should be available by Christmas. Check this column next month for full details.

Model II owners have been asking for a LOAD80 of Model II

programs, as well. This project is also under development and an announcement is planned for our December issue. The Model II LOAD80 will be a bit more expensive than either the reguler LOAD80 or the special Color LOAD80, since it will be disk based

The response to the LOAD80 project has been almost overwhelming. The Editors of the magazine are glad to be able to make this service available. We appreciate your feedback. Send your LOAD80 comments to this column, care of 80 Microcomputing, 80 Pine Street, Peterborough, NH 03458.

Next month, we'll delve into the mysteries of the Editor/Assembler, a subject postponed from this month because of the great number of Color Computer inquiries. ■

October	LOAD80	Directory	

PGM#	Fileneme	Page	Comments	
1	MASTMIND	122	None	
2	SYLLOG	132	None	
3	VOICE	141	None	
4	SPEAK	141	None	
5	TYPE	141	None	•
6	TALKER	146	None	
7	BSKTBALL	184	None	
8	HOMEINVT	220	None	
9	BOOKS	234	None	
10	SUNSET	272	None	
11	FREEZER	274	None	
12	TRSCPM	288	None	
13	YAHTZEE	302	None	
14	BRIDGE	306	None	
15	FIREFGHT	316	None	
16	SPACE	334	None	
17	JERICHO	350	None	
18	TPRGEN/SCR	196	Needs EDTASM	
19	AUTOKEY/SRC	242	Needs EDTASM	
20	ASMPTCH/SRC	326	Needs EDTASM	
21	EDASFIX/SRC	344	Needs EDTASM	
22	COPYIT/SRC	370	Needs EDTASM	

Do You Have Disk Errors?

Over 90% of Disk errors are caused by two things. Bad disks and not having a data seperator. If you haven't ordered Percom's Doubler II then see our adfor details and order one now. You will not believe the improvement in your system. If you are having CRC errors, Data not found, or other errors especially in the higher numbered tracks you probably have a bad or worn out disk.

Every disk sold is certified but there is a big difference between brands. Some brands just barely pass the ANSI certification standards, others like WABASH produce disks that are far better than the minimum standards. (Wabash sells the disks that aren't good enough to put the Wabash Label on to Discount outlets that sell them as off brands and no Label disks.) WABASH Disks are certified over the entire useable disk surface. Despite repeated use and normal wear and calibration drift on your drive system, WABASH disks will continue to work reliably - long after the so called bargain brands have failed. That's why WABASH

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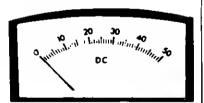
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It you haven't got a doubler for your Model I, order one now, this is the greatest thing to come along for the Model I. Since it actually reduces disk read/write errors, your system will run better with a PERCOM doubler. And you will also save both time and money by having more programs per diskette.

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80 CALENDAR

October

Oct. 2 and 3 A two-day conference on "Clessroom Applications of Computers" will be conducted at Independence High School, San Jose, CA, by Computer-Using Educators and Santa Clara Valley Mathematics Assn. The Conference will cover mathematics, science, business, music, special education, language arts and administrative epplications of computers at levels ranging from pre-school through college. Informetion is available from Computer-Using Educators, Independence High School, 1776 Educational Park Dr., San Jose, CA 95133.

Oct. 24 and 25 The second annual New Jersey Microcomputer Show and Fleamarket is scheduled at the Holiday Inn North Convention Center, Newark, NJ. The show will feature 75 commercial exhibitors and more than 100 outdoor fleamarket vendors and usergroup meetings for TRS-80s. Admission for the show end fleamarket is \$5; for the fleamarket only, \$3. It is sponsored by Kengore Corp., 3001 Rte. 27, Franklin NJ 08823.

Oct. 26-Nov. 4 Virginia Polytechnic Institute and State University will conduct three workshops in October and November. Digital Electronics for Automation and Instrumentation will be Oct. 26-28; Microcomputar Design Interfacing and Programming using Z80/8085/8080 will be Oct. 29-31; and Scientific Instrument Automation, Interfacing and Programming using the

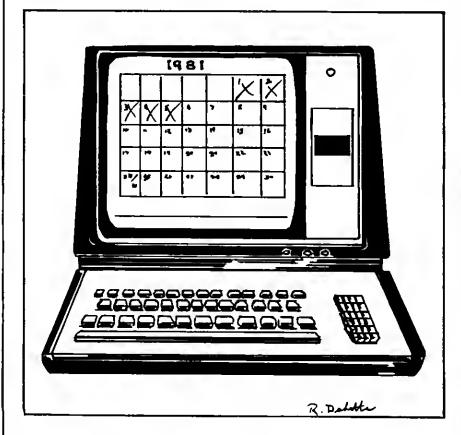
TRS-80 microcomputar will be Nov. 2-4. Information is available from Dr. Lindy Leffel, CEC, Virginia Tech, Blecksburg, VA 24061.

Technical Education Research Centers, 6 Eliot St., Cambridge, MA 02138, will sponsor a series of workshops on Microcomputera in Education" in College Park, MD, Oct 2-4; Toronto, Canada, October 22-24; and Cambridge, MA, Nov. 22-24. They will include a discussion of aducational issues, three microcomputer languages and laboratory and science applications of microcomputers.

The commission on Software Issues In the '80s, 1301 20th St., N.W., Suite 116, Washington, DC 20036, will sponsor the National Conference on Software: Critical Decisions, at the Shoreham Hotel, Washington, DC, Oct. 5–6. Subject areas will include education, software protection, technical issues and taxation.

The University of California, Berkeley, will sponsor a two-day course on "Bit-Slica Microprocessor Dealgn" for engineers and engineering managers at the Marriott Santa Clara Hotel, Santa Clara, CA Oct 26-27. Fee is \$350. Interested perties can register through the Office of Continuing Education in Engineering, University of California Extension, 2223 Fulton St., Berkeley, CA 94720.

Ken Orr and Associetes, Inc., 715 E. 8th St., Topeke, KS 66607, will sponsor courses and conferences on several issues in October. Subjects are: Oct.



5-7, Data Structured Systems Design Users Conference, Topeka: Oct. 6, Systams Maintenance Update Conference, Topeks; Oct. 19-23, Structured Systems Design, Kaness City, MO; Oct. 20-23, Structured Requirements Definition, Atlente, GA; Oct. 27-29, Structured Data Base Design, Topeks; Oct. 27-30. Structured Requirements Definition, Denver, CO.

The New Mexico Computer Society will host the third annual New Mexico Computer Fsir Nov. 14 at the Albuquerque Civic Auditorium, Admission is free. Information is available from Ron Benninghoff, c/o New Mexico Computer Society, 515 Wyoming NE No. 2, Albuquerque, NM 87108

Structured Program Design Combined Couree, St. Louis, MO; Nov. 10-13, Structured Requirements Definition, Los Angeles, CA; Nov. 16-20, Structured Systems Design/Structured Progrsm Design Combined Course, Wsshington, DC.

November

The University of California, Berkelev, will sponsor a two-day course titled "Comparison of Recent Microcomputer Architectures" for design engineers, programmers and technical managers at the San Francisco Airport Hilton, Nov. 9-19. Fee is \$400. Information and registration is available through the office of Continuing Education in Engineering, University of California Extension, 2223 Fulton St., Berkely, CA 94720

Ken Orr and Associates, Inc., 715 E. 8th St., Topeka, KS 66607, will sponsor several courses and conferences in November, Subjects are: Nov. 3-8 Structured Requirements Definition, San Antonio, TX; Nov. 3-8, Structured Progrsm Design, Boston, MA; Nov. 10, Management Overview of Data Structured Systems Development, Denver, CO; Nov. 11, Msnsgement Overview of Dats Structured Systeme Development, Portland, OR; Nov. 13, Msnsgement Overview of Dats Structured Systama Development, Saattle, WA; Nov. 9-13, Structured Systems Design/

December

Ken Orr and Associates, Inc., 715 E. 8th St., Topeka, KS 66607 will run several courses in December, Subjects are: Dec. 1-4, Structured Systems Design, Chicego, IL; Dec. 8-19, Structured Program Design for Teleprocessing, Topeke, KS; Dec. 8-11, Structured Requirements Definition, Philedeiphis, PA; Dec. 9-11, Structured Program Design, Ksnsss City, MD; Dec. 14-18, Structured Systems Design/ Structured Program Deelgn Combined Course, Atlanta, GA.

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FREE CATALOG



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Leave typing to typists. Enter data the easy way.

Copyit

```
Program Listing 1. Copyit
               00001 ;
                       ***** COPYIT *****
               00002; BY RON BALEWSKI
                       12/19/1900
               00003
               00003 ; 12/19
00100 CSRPOS
4020
                              EQU
                                       4020H
9999
               00110 KEYSCS
                              EOU
0001
               00120 BREAK
                              EQU
               00125
                       SHOOWN CAS
                                    BΕ
                                       CHANGED TO ANY DESIRED TURN-OS CODE
001A
               00130 SHDOWN
                              EQU
                                       26
40A4
               00140 BASBEG
4020
               00150 CSRPOS
                               EQU
                                        4020H
0000
               00160 KEYSCN
                               EQU
0001
               00170 BREAK
                               EOU
001A
               00100 SHDOWN
                               εQυ
                                        40A48
40A4
               00190 BASSEG
                               EOU
005F
               00200 CURSOR
                                                         ; CURSOR CHARACTER
42E9
               00210
                               ORG
                                        42E9H
               00211
               00212
               00213
               00214
                     ; ESTRY POIST -- IF COPY IS PROGRESS, GO TO COSSES
               00215
                                      CALL RADIO SHACK KEYBOARD DRIVER
               00216
                                      IF CHARACTER RETURNED = SSIFT-DOWN-ARROW
                                          THEN GO TO START A COPY OTRERWISE GIVE
               00217
               00210
                                          THE CHARACTER TO BASIC
               00219
42E9 3A6443
               00220
                     COPYIT
                              LD
                                       A, (OUPFLG)
                                                         : COPY IN PROGRESS?
42EC B7
               00230
                               OR
42E0 2060
               00240
                               .TR
                                       NZ, CONSEN
                                                         : IF SO, COSTISUE SENDING
42EF C00000
               00250 KEYADD
                              CALL
                                                         CALL R S KEYBOARD DRIVER
                                       KEYSCN
               00260
                        THE ADDRESS OF THE ABOVE CALL WILL BE LOADED IN DURING
                     :
                        THE PROGRAM SETUP TIME.
42F2 FE1A
               00200
                                       SEDOWN
                                                         ; SHIFT-DOWN PRESSED?
                               CP
42F4 CØ
               00290
                               RET
                                       NZ
                                                         ; IF NOT, RETURN
               00295
               00296
               00297
               00300
                        START COPY AFTER SHIFT-DOWN PRESSED
               00301
               00302
                        ASK FOR AND DECODE DESIRED LINE NUMBER.
               00303
                        IF 0, LEAVE COPYIT
               00304
                        IF BREAK PRESSED DURING INPUT, LEAVE COPYLT WITE A
               00305
                              BREAK CHARACTER
42F5 D9
               00310
                               EXX
                                                         SWAP REGS
42F6 216F43
               00340
                               T.O
                                        SL, SSG1
                                                         POINT TO COPY LINE MSG
42F9 CDA728
               00350
                                                         ; PRINT IT
                               CALL
                                        20A7H
42FC 216543
               00360
                               LD
                                        SL, COPBUF
                                                         GET ADO OF MY INPUT BUFF
42FF 0600
               00370
                               LD
                                        в, 0
                                                         ; MAX OF 0 CHARACTERS
4301 CDD905
                                                         ; CALL ISPUT RTN ; QUIT W/ BREAK?
               00300
                               CALL
                                        Ø5D9R
4304 FE01
               00390
                               CP
                                        BREAK
4306 2845
               00400
                               JR
                                        Z, EXIT
                                                         ; IF SO, LEAVE W/ BREAK
4300 385F
               00410
                               LD
                                        A, CURSOR
                                                         GET CURSOR
430A 322240
               00420
                               Lΰ
                                        (4022H),A
                                                         ; TURN CURSOR BACK ON
430D CD5AlE
               00430
                               CALL
                                        1E5AR
                                                         CONVERT # TO BISARY
4310 7A
               00440
                               LD
                                        A,D
                                                         # RETURNED?
4311 B3
               00450
                               OR
4312 2039
               00460
                                        Z,EXIT
                                                         ; IF SO, LEAVE
               00461
               00462
               00463
                         BEGIS SEARCHING BASIC TEXT FOR DESIRED LINE NUMBER
               00464
                         IF PRESENT, GO TO FOUND ELSE GO TO SOTFND
                00465 ;
                                                                       Program continues
```

Ron Balewski 412 E. Ridge St. Nanticoke, PA 18634

van Christmas can be tedious. About a week before the lest Yule, I typed some seasonal music on my TRS-80. Because most songs contein more than one verse, and Christmas tunes are no exception, I found myself typing identical data statements over and over—not something I enjoy.

Since I had elready typed the data once, I figured all I had to do was find it.

Copylt

I wrote a short utility (2K plus) that can save you time retyping long, tedious data statements when they are repeated in any Basic program. I call it Copyit.

Copyit lets you duplicate one line of Besic code in enother. I placed it in low memory (below Basic) to eliminate the need for separete programs for 16, 32 and 48K machines. I patched Copyit into the keyboard's device control block (DCB), so that each time you strike a character, Basic calls Copyit, Instead of the usual input routine.

Copyit checks a flag that indicates you need a copy of a previous data statement. If the flag says no, Copyit calls the key-

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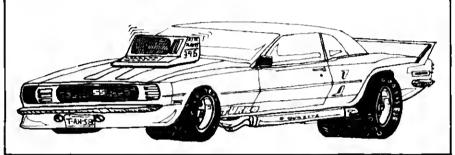
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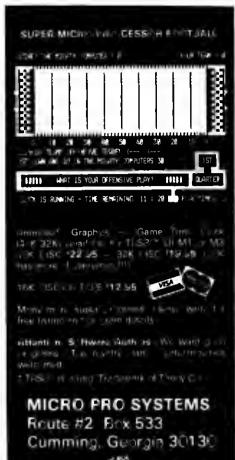
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board driver.

If you pressed any cheracter other than a shift down-arrow Basic records the character in the A register as usual.

If the kayboard driver returns the shift down-arrow, you'll activate Copyit and it will ask you for a line number. The routine converts this number to binary and searches for It. If Copyit can't find the line, it prints a message to that effect and terminates itself, until you activate It again.

If the routine finds the line number, it sets a "next-byte-tocopy" pointer to the first character of that line, turns on the copy flag, sets the A register to zero and returns control to Basic. Setting the A register to zero fools the computer into thinking that nothing has happened.

From this point on, whenever the keyboard is scanned and the copy flag is on, Copyit reads the "next-byte-to-copy" pointer. It loads this byte into the A register, and the pointer is bumped up one. Control is then returned to Basic with the character in the A register, just as if you had typed it.

Since the copy flag remains on, the entire line will be sent to Basic, character by character, until the "next-byte-to-copy" is zero. If so, Copylt has found the end of the line; it turns off the flag, and Basic resumes.

Operating Instructions

Let's take an example. To copy line 10 into line 20, type: 20 ahift down-arrow. Copyit will reapond with: Line Number?

You then type 10 and hit Enter. Hit Enter once again, and you have rejoined Basic.

If your machine has a new ROM, you will have to type: shift down-arrow Z to activate Copyit. You can tell if you have a new ROM, because your computer will ask you for the Memory Size while, if your computer has an old ROM, it will ask you for the Memory Size. You can change this by replecing the 26 in line 130 with the ASCII code you went to use.

You can activate Copyit at

Program Listing 1 Cor	tinued			
4314 DD2AA440 4316 D06E62 4318 D06603 431E DF 431F 200D 4321 3020	00400 PROLIN I 00490 I 00500 I 00510 S	LD LD RST JR		;POINT TO BEGIN OF BASIC ;GET CURRENT LINE * ;COMPARE WITH * WANTED ;JUMP IF FOUND ;IF CURRENT>WANTED ; THEN NOT IN TEXT.
4323 D06601 4326 DD6E00 4329 E5 432A DDE1 432C 18EA	00540 I 00550 I 00560 I 00570 I	LO PUSH POP	E,(IX+1) L,(IX+0) EL IX PROLIN	;GET ADD OF NEXT LINE ;TRANSFER TO ; POINTER ;GO PROCESS THIS LINE
432E 3E01 4330 326443 4333 DD23 4335 OD23 4337 DD23 4339 DD23 4338 DD226243	00503; 00504;FOUND	THE NEXT LD LO INC INC INC INC LD	CALLS TO FETCH A,1 (DUPFLG),A IX IX IX IX IX (CURBYT),IX	PFLG) ANO SET POINTER FOR THE TEXT THEN LEAVE. ; SET COPY IN PROGRESS FLG ; BUMP PAST ; NEXT LINE PTR ; BUMP PAST ; LINE \$; POINT TO WHERE TO START ; COPYING FROM
433F 3E00 4341 160A	00670	LD JR	A,0 EXIT	; SAY NOTHING HAPPENED ; GO BACK TO BASICS
4343 217C43 4346 CDA728 4349 3E00 434B 1000 434D D9 434E C9	00684 ; NOTFND- 00690 NOTFND 00700 00710 00720 00840 EXIT 00050 00860 ; 00670 ;	LD CALL LD JR EXX RET - CONTIN	26A7B A, 0 EXIT	;POINT TO HOT FOUND MSG ;PRINT IT ;LEAVE ;RE-SWAP REGS CURRENT LINE BEING COPIEO
434F D9 4350 2A6243 4353 7E 4354 B7 4355 2006 4357 23 4358 D9 435B D9 435B C9 435D 326443 4360 D9 4361 C9 4362 0000 4364 00 4364 00 4364 00 4367 20 437B 00 438C 00	00930 00940 00950 00950 00970 00990 01000 QUIT 01010 01020 01030 CURBYT 01040 DUPFLG 01050 COPBUP 01050 COPBUP	EXX	BY BYTE 'TILL IT' BL, (CURBYT) A, (BL) A Z,QUIT BL (CURBYT), BL (DUPFLG), A 0 0 10 ' COPY LINE?' 0 ' LINE NOT FOUND	; SWAP REGS ; POINT TO BYTE TO BE SENT ; SYTE TO BE SENT 0? ; IF SD, LINE ENDED, OUIT ; BUMP TO NEXT CHR ; & PUT FOR NEXT TIME ; RESWAP REGS ; BACK TO BASIC ; TURN OFF COPY FLAG ; RE-SWAP REGS ; BACK TO BASIC ; TURN OFF COPY FLAG ; RE-SWAP REGS ; BACX TO BASIC ; NEXT-TO-SEND POINTER ; DUPLICATION FLAG
4300 210043 4390 3600 4392 23 4393 22A440 4396 21191A 4399 E5 439A 2A1640 439D 22P042 43A0 21E942 43A0 21E942 43A6 C34D1B 438D	01093; 01094; SETUP- 01095; 01096; 01097; 01100 SETUP 01110 01130 01130 01140 01150 01160 01170 01190 01190	IT GETS PATCHES	START-BASIC POI	TTEN BY YOUR BASIC. NTER TO ITS BEGINNING, KEYBOARD DCB, AND "NEW" COMMAND. ; WHERE BASIC WILL START ; INITIALIZE TD 0 ; PUT IN BASIC PGM PTR ; GET READY ADD ; PUT READY ON STACK ; GET KED DRIVER ADD ; SAVE IT FOR USE ; GET MY ADDRESS ; MAXE ME NEW DRIVER ; GO NEW AND READY

statement or two before copying line 10; you can also copy any time, not just at the begin-something after copying line ning of a line. You can type a 10, but before entering the line; or you can copy line 10 into line 20 more than one time.

Once you see how much typing Copylt can save you, you'll start loading it habitually before typing long data statements. Remember, you may have to move those statements.

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Listprog

Doug Riffel 1836 Metzerott Road #906 Adelphi, MD 20783

have always been a stickler for neat and legible program documentation. Consequently, I quarkly became frustrated at the tetel lack of form control incorporated in the Basic LLIST command. Even NEWDOS/80 with all Its extensions to Disk Basic offers no help.

There were two basic features I wanted. I quickly found that automatically feeding the page

over the perforation was not as easy as I thought it would be. I also wanted to indent the lines to provide room for three-hole punching so the program listings could be stored in binders.

I also wanted some other neat little goodies. First, the name of the program should appear prominently in the header. Second, I wanted to print the date the program is listed. Third, I needed page numbering and finally, double-spacing between statements to provide for pencil corrections.

All these features have been

incorporated in Program Listing 1, which I call Listprog. It requires Disk Basic and NEWDOS/80 to operete, end will work equally well with TRSDOS with the deletion of line 1000.

Although Listprog was written to capitalize on some of the features of Radio Shack's Line Printer IV (Centronics 737), with some minor modifications it will work just as well with other printers. The necessary modifications will be covered later.

Listprog

Whenever a printed line exceeds the line length of the printer, the printer logic automatically prints across a full line and then prints the remainder on the following line. When this happens, location 16425 (Basic's line counter) does not get updated. This, in essence, means total loss of form control.

A similar situation occurs if the down arrow is encountered within a statement. I use the down arrow quite frequently to print multiple lines on the screen with one statement. If the printer logic detects this character, the line up to that point is printed and the remainder is printed on the following line. Again, the Besic line counter is not updated.

When a program is stored on disk in ASCII format, the first space encountered in a statement is always the separator between the statement number and the statement text.

Lines 10 and 20 of Listprog merely clear string space and set certain variables. Line 1000 (NEWDOS/80 only) examines TIME\$ to see if a date has been entered. If not, it requests the date and executes a DOS command to set it.

Lines 1010 and 1020 request the filespec end open that file.

Line 1030 examines the filespec for the presence of a slash. If a slash is present, it and everything to the right of it (the file extension) is discarded. I personally prefer to keep ASCII-formatted program files separate from the Basic program files by using the filespec extension "ITXT"; therefore, the extension on the filespec actually being printed is irrelevent.

Line 1040 prints the header which consists of the program name, printed at five characters per Inch, and the date, printed at 10 characters per inch. For any printer other than the LP IV, this line should be modified accordingly.

Line 1050 turns on the 16.7 characters per inch mode (132

```
10 CLS:CLEAR 589;PN-1
20 PORE 16425,1:PT-189:IN-15
1098 IF LEPTS(TIMES,2)-998 THEN INPUT Enter todays date (MM/DD /YY)*,785:IF LEN(AS)-88 THEN AS-"OATE "+A$:CND"AS*
1018 CLS:MPDUT*FILE NAME;FLS
1028 OPEN "I",1;FLS
1039 SL=INSTR(FLS,"/*)-1:IF SL<1 THEN SL-LEN(FLS)
1040 LPRINTCHRS(27);CHRS(19);CHRS(27);CHRS(14);TAB(19);LEPTS(PLS,SL);CHRS(27);CHRS(15);TAB(42);TAB(42);TAB(42);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43);TAB(43)
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Program Listing





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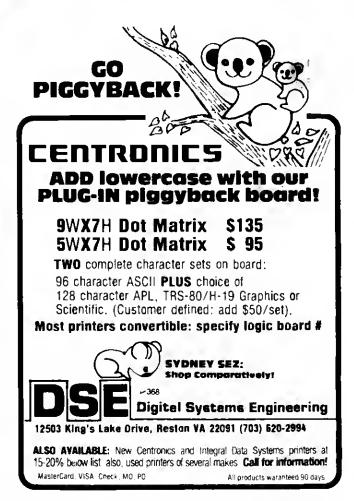


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characters per line for the LP IV) and prints the page number. This line should also be modified for printers other than the

Line 1060 returns the printer to 10 character per inch, ejects the last je and terminetes Listprog Line 1070 is the required form for inputting ASCII-formatted program files.

Line 1080 provides the necessary set-up information for the remainder of the program. There are really two left margins, one for the stetement number and one for the statement text. The length of the printed statement text line is predetermined by the value assigned to variable PT in line 20. The left margin for the statement number is also predetermined in line 20 by varieble IN. For printers with line lengths different than the LP IV, these variables may be changed; however, IN +8 + PT cannot exceed the line length of the printer.

Other variables and their use

are as follows:

- *SP = Location of the space separator between line number and text
- *TS = Beginning of statement text
- •TL = Length of statement
- *NL = Number of full PTcharacter lines to be printed •EC = Number of characters in last line if less than PT

Lines 1090-1110 search the statement text for the down arrow (CHR\$(10)) and replace it with the ASCII caret (CHR\$ (94)). If the printer you are using cennot print this character, you will want to change these lines.

Lines 1130-1170 perform the actual printing, feeding properly over the paper perfora-

Listprog has become an extremely popular program on my TRS-60 and I use it to document all my Basic programs. The program logic is quite simple and lends itself to easy tailoring for individual preferences.

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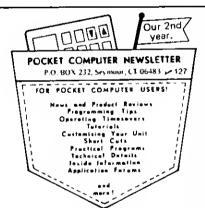


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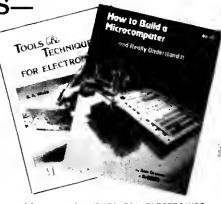
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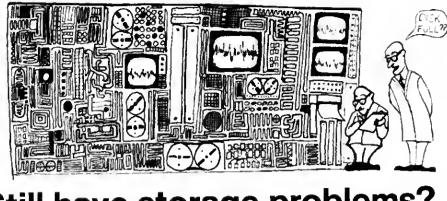
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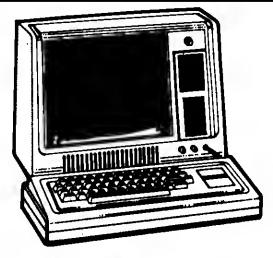
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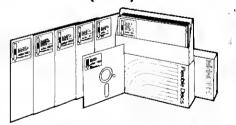








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